

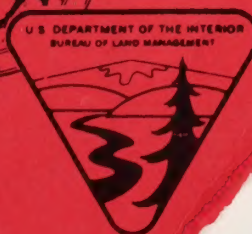
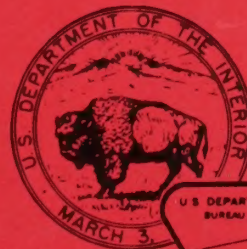
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ALLEN—WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

FINAL
VOLUME 1: TEXT



United States Department of The Interior
Bureau of Land Management



United States Department of the Interior

IN REPLY REFER TO

BUREAU OF LAND MANAGEMENT

A significant amount of new information that had not been available during the preparation of the draft environmental impact statement has been included in this final document. In addition, 138 comment letters were received regarding the draft, along with voluminous hearing transcript and exhibit comments. As a result, this final EIS is in two volumes. Volume 1 contains the revised and expanded complete text, along with references cited, appendixes, etc. Volume 2 contains copies of comment letters, excerpts from the various hearings transcripts, the complete written exhibits received at the hearings, and BLM responses to substantive comments contained in this material. In accordance with the requirements of the Council on Environmental Quality and the National Environmental Protection Act, a comment period has been established for this document, which will extend from November 17 through December 17, 1980. All comments received during this period will be evaluated, summarized, and incorporated into the decision making process of the Secretary of the Interior.

Any comments concerning these two volumes should be sent to:

District Manager
Cedar City District
Bureau of Land Management
1579 North Main
P.O. Box 724
Cedar City, Utah 84720

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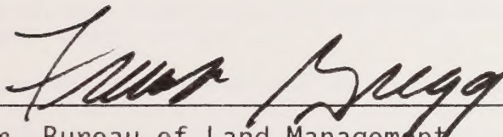
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DEPARTMENT OF THE INTERIOR
FINAL
ENVIRONMENTAL IMPACT STATEMENT
ON
ALLEN-WARNER VALLEY
ENERGY SYSTEM

Prepared by
Bureau of Land Management
Department of the Interior



Director, Bureau of Land Management

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COVER SHEET

Allen Warner Valley Energy System
Environmental Impact Statement

() Draft

(X) Final

Lead Agency

U.S. Department of the Interior, Bureau of Land Management

Agencies Which Provided Information

Environmental Protection Agency
State of California Energy Commission
State of California Public Utilities
Commission
U.S. Department of Agriculture
Soil Conservation Service
U.S. Department of the Interior
Fish and Wildlife Service
Geological Survey
Heritage Conservation and
Recreation Service
National Park Service
Office of Surface Mining
U.S. Department of Transportation
Federal Aviation Administration

Other Responsible
Agencies with Jurisdiction

Federal Communication Commission
Interstate Commerce Commission
President's Advisory Council on
Historic Preservation
U.S. Department of Agriculture
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Army Corps of Engineers
U.S. Department of Energy
U.S. Department of the Interior
Bureau of Indian Affairs
U.S. Department of Transportation
Federal Highway Administration
Western Area Power Administration

States, Counties, and Reservations that Could be Directly Affected

State of Arizona
Mojave County
State of California
San Bernardino County
State of Utah
Carbon County
Emery County
Kane County
Piute County
Sanpete County
Sevier County
Washington County
Wayne County

State of Nevada
Clark County
State of Wyoming
Lincoln County
Sweetwater County
Uinta County
Moapa Indian Reservation

Abstract

This statement assesses and comparatively evaluates the environmental consequences of six alternatives designed to meet, at least in part, the base load energy needs of Nevada Power Company, Southern California Edison, Pacific Gas & Electric, and the city of St. George, Utah. The statement focuses on alternative coal-fired electrical generating systems, water projects, and energy conservation in combination with nonconventional energy sources.

The major environmental topics discussed are related to air quality, hydrology, socioeconomics, threatened and endangered species, cultural resources, aesthetics, and land use. A discussion is also provided on the "need for power" question.

The document also identifies the BLM preferred alternative, which recommends the authorization of public land use for the Harry Allen powerplant and the I-15 transmission line corridor.

Comments on the draft environmental impact statement are listed in Volume II.

Questions and comments concerning this statement should be directed to:

Mr. Morgan Jensen
District Manager
Bureau of Land Management
P.O. Box 724
1579 North Main Street
Cedar City, Utah 84720

Date by Which Comments on the Final Statement Must be Received: December 17, 1980

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SUMMARY

INTRODUCTION

Four utilities and a county water conservancy district have applied to the Bureau of Land Management (BLM) for rights-of-way to utilize public lands in the development of their proposed Allen-Warner Valley (AWV) energy system. Nevada Power Company (NPC), Southern California Edison, (SCE), Pacific Gas and Electric (PG&E), and the city of St. George propose to construct and operate a 2,500-megawatt (MW) coal-fired steam-electric generating system in the southern areas of Utah and Nevada. A 500-MW powerplant (Warner Valley) would be located in Warner Valley, Utah, and a 2,000-MW powerplant (Harry Allen) would be located in Dry Lake, Nevada. Water to cool the Warner Valley powerplant would be supplied by the proposed Warner Valley water project. Water to cool the Harry Allen plant would be supplied primarily from the Clark County (Nevada) Advanced Wastewater Treatment facility via a 24.5-mile long pipeline. Although several coal sources are being considered, the applicants preferred source is the Alton coal lease area of southern Utah. Approximately 11 million tons of coal would be mined annually from the Alton coal lease area using surface and underground mining methods. Two coal slurry pipelines (12 and 22 inches in diameter) would transport the coal to the powerplants. An electrical transmission system and a supporting communication system would deliver power to market areas in Utah, Nevada, and California.

The initial electrical generating capacity entitlements of the participating utilities from the proposed AWV energy system in 1990 would be:

<u>Participants</u>	<u>Initial Capacity Entitlement (MW)</u>
Nevada Power Company	285
Southern California Edison Company	1,045
Pacific Gas and Electric Company	1,045
City of St. George	125

After initial operation, and throughout the remainder of the proposed project life, NPC would recapture station capacity of the Harry Allen powerplant from SCE and PG&E to supply their customers' electrical energy needs.

In support of the proposed 500-MW Warner Valley powerplant, the Washington County Water Conservancy District has proposed the construction of a 55,000 acre-foot reservoir in Warner Valley, Utah. As proposed, this water storage facility would consist of a water diversion structure on the Virgin River, 16 miles of canal and pipelines, an earthen dam 224 feet high and 3,340 feet long, and a culinary water treatment facility. The reservoir would be used for cooling the Warner Valley powerplant (10,000 acre-feet), as supplementary irrigation water (8,000 acre-feet), as a source of municipal and industrial water (26,400 acre-feet), and the remainder as a powerplant reserve and for dead storage.

According to the Washington County Water Conservancy District, construction of the water project is not wholly dependent on the construction of the proposed Warner Valley powerplant since the major purpose of the water

project would be to provide a water source for five southwestern Utah municipalities, not to provide powerplant cooling water. However, the Warner Valley powerplant would be dependent on the water project for its water supply. Therefore, the Warner Valley water project should be considered a separate and distinct project related to but not dependent upon the AWW energy system.

In this regard, the Warner Valley water project has been identified as a potential State-sponsored project for construction under the State of Utah Water Conservation and Development Program (Water Bonding Fund); however, the following two qualifications exist: (1) no schedule has been assigned for State action, and (2) the project may be redesigned (scaled down) to fit the State money available (the State development program has not yet identified enough money to build the project as currently designed). Supplemental environmental analysis would be needed for a redesigned project if and when the State decided to undertake sponsorship. However, the State of Utah would rather have the water project constructed as part of the AWW energy system (personal communication, J. Butler, Utah State Planning Office, May 15, 1980).

In accordance with the National Environmental Policy Act of 1969 (as amended) and the implementing regulations of the Council on Environmental Quality (Federal Register, Volume 43, Number 230), the proposed project was presented to the public for comment. Several "scoping" meetings were held during July 1979 in Utah and Nevada. Participants at the meetings identified the following as being of primary concern in analyzing the applicants' proposal: hydrology, socioeconomics, air quality values (including visibility), land use, threatened and endangered species, wilderness values, aesthetic considerations, and the impacts of mining in the Alton coal lease area.

In addition to establishing the major areas of concern, the scoping meeting participants also identified approximately 46 possible alternatives to the applicants' proposal. To determine which of the suggested alternatives were reasonable, a set of alternative evaluation criteria was established through a public comment and review procedure. Applying these criteria to the 46 suggested alternatives resulted in the identification of the following five reasonable alternatives to the applicants' proposal.

Construct a 2,000-MW Powerplant at the Harry Allen Site and Slurry Coal from the Alton Coal Lease Area

This alternative would consist of a 2,000-MW powerplant at Dry Lake, Nevada. Approximately 9 million tons of coal would be produced annually from the Alton coal lease area of southern Utah. A 22-inch coal slurry pipeline would transport coal from the coal lease area to the powerplant. A 345 and 500-kilovolt (kV) transmission system would be developed to provide power to the Las Vegas and southern California service areas. For analysis purposes, under this alternative it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from participants of the Intermountain Power Project.

Construct a 250-MW Powerplant at Warner Valley with Coal Trucked from the Alton Coal Lease Area, Construct the Warner Valley Water Project, and Construct a 1,000-MW Powerplant at the Harry Allen Site with Coal Railed from Central Utah or Southwestern Wyoming

This alternative would consist of a 250-MW powerplant and a 55,000 acre-foot reservoir in Warner Valley, Utah, and a 1,000-MW powerplant in Dry Lake, Nevada. About 1 million tons of coal would be trucked annually from the western half of the Alton coal lease area to the Warner Valley powerplant. Coal for the Harry Allen powerplant would be railed from central Utah or southwestern Wyoming (3 or 4 million tons annually). Electrical transmission facilities would be the same as the applicants' proposal, although at a smaller scale.

Although the Warner Valley water project would be used to supply cooling water to the Warner Valley powerplant, the water project would be constructed for the primary purposes of municipal, industrial, agricultural, and interim uses such as recreation.

Construct a 2,000-MW Powerplant at the Harry Allen Site with Coal Railed from Central Utah or Southwestern Wyoming

This alternative would utilize coal from the fields of central Utah or southwestern Wyoming. Coal would be delivered to the Harry Allen 2,000-MW powerplant over existing rail lines. A system of 345 and 500-kV powerlines would provide power to the Las Vegas and California service areas. For analysis purposes, under this alternative it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from participants of the Intermountain Power Project.

Energy Conservation and the Development of Alternative Energy Sources

This alternative would involve the implementation of intensive conservation and load-management programs in the city of St. George and NPC service areas. In the service areas of PG&E and SCE in California, three major existing programs would be accelerated: the development of alternative (nonconventional) energy sources, the development of renewable energy sources (solar technology), and conservation/load management.

No Action

This alternative consists of an evaluation of the consequences of not implementing the applicants' proposal, the reasonable alternatives, or any combination of the applicants' proposal and the reasonable alternatives.

PURPOSE AND NEED OF PROPOSED PROJECT

According to the project applicants, the AWV energy system is needed to help meet the increasing demand for electrical energy in their respective service areas (load growth).

NPC's need for 285 MW of additional capacity (in 1990) has been verified by the Nevada Public Service Commission and by independent BLM assessments.

The California Public Utilities Commission (CPUC) must grant the California Utilities (PG&E and SCE) a Certificate of Public Convenience and Necessity in order for them to participate in the AWV energy system. The CPUC Allen-Warner project team has recommended to the Commission that they grant a certificate to PG&E and SCE for their participation in the Allen powerplant, with an allocation of up to 920 MW each for the purpose of displacing oil-fired generating capacity.

The CPUC project team has also recommended against using Alton coal slurried to the Allen powerplant because of its expense and low heat value; and instead has recommended that high-heat, low sulfur coal be railed to the Allen powerplant. The project team further recommended that the Commission require the development of a program of nonconventional energy sources as part of the conditions for granting participation in the Allen powerplant.

According to independent BLM assessments, the city of St. George would need 10 MW of its initial allocation of 125 MW from the proposed Warner Valley powerplant by the year 1990.

BLM assessments indicate that there is no demonstrated need for the proposed Warner Valley water project for municipal and industrial (culinary) uses for five southwestern Utah municipalities because their water systems' present production capacity is adequate through the year 2000. There appears to be a need for an undetermined amount of water that would be represented by the water project for supplemental irrigation waters to offset a moisture deficit in July and August of each year in the St. George/Washington Fields area.

MAJOR ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ALTERNATIVE ACTIONS

As specified under the Council on Environmental Quality Final Implementing Regulations of the National Environmental Policy Act of 1969 (as amended), the applicants' proposal and the five alternatives were evaluated to determine their potential major environmental impacts. A summary of the results of the evaluation are presented below.

Alternative 1: Applicants' Proposal

Preliminary air quality screening evaluations done by the Environmental Protection Agency (EPA) in Regions VIII and IX indicate that there could be violations of air quality standards with the operation of the proposed Warner Valley and Harry Allen powerplants. Emissions from the Warner Valley powerplant could cause violations of air quality Class I standards in Zion National Park. EPA Region VIII proposed to disapprove the Warner Valley powerplant on October 2, 1980. Based on EPA's screening evaluation, air quality Class II standards in the immediate areas of the Harry Allen and Warner Valley powerplants could also be exceeded. EPA Region IX's analysis for the Harry Allen powerplant shows that the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) would be exceeded.

EPA Region IX has approved an air quality model for more detailed analysis for the Harry Allen powerplant. NPC will submit the results of the modeling analysis along with additional Best Available Control Technology (BACT) information as part of the continuing Prevention of Significant Deterioration (PSD) permit review for the Harry Allen powerplant. Information is not presently available on possible cumulative air quality impacts from the proposed Harry Allen powerplant, the portion of the Reid Gardner powerplant now under construction, and the existing units of the Reid Gardner powerplant. Definitive conclusions regarding the extent, duration, and importance of these air quality impacts have not yet been made by the responsible Federal and State agencies, but these concerns must be resolved before issuance of PSD and construction permits.

In accordance with the Clean Air Act (as amended, 1977), visibility has been identified by the National Park Service (NPS) as an important air quality related value in Bryce Canyon and Zion National Parks. Systems Applications, Inc., under contract to EPA, performed a visibility analysis for the Alton coal lease area as viewed from Yovimpa Point in Bryce Canyon National Park. The analysis indicated that localized particulate plumes would cause visibility impairment in the form of whitish-gray clouds or haze layers visible against the dark tree-covered background. The visible plume would be 10° to 20° (0.8 to 1.6 miles) wide, 1.0° (400 feet) high, and visual range looking through the plume from Yovimpa Point under neutral and stable conditions would be reduced 5 to 25 percent. NPS has prepared several photographic simulations that show possible visual impacts to Zion National Park. These simulations indicate that a plume would be visible from viewpoints within Zion National Park. Environmental Research and Technology, under contract to Utah International, Inc. analyzed impacts to visual range from the proposed Alton coal mine and concluded that although occasional decreases in visual range and apparent view contrast would be observed from Yovimpa Point in Bryce Canyon National Park and Lava Point in Zion National Park, in general, any change in visibility from the Alton mine would be observed less than 1 percent of the time.

Operation of the proposed powerplants would utilize a portion of the appropriate PSD increment within Warner Valley, Utah and Dry Lake, Nevada. Utilization of this increment would impose a restriction on future industrial growth in the area (i.e., future development would have to accommodate itself within that portion remaining of the allowable Class I or II increments). The extent of this restriction will not be known until EPA completes its PSD permit review process.

The pumping of 10,000 acre-feet of ground water per year from the Navajo Sandstone Formation near Alton, Utah could adversely affect up to 20 nearby springs. The extent and severity of the possible impacts cannot be determined until an intensive program of test drilling and pumping is conducted. According to the State of Utah Department of Natural Resources, Division of Water Rights "approval [of the Alton well field] could not be made if there is known or even suspected interference possible [with approved water rights]."

According to a biological opinion prepared by the U.S. Fish and Wildlife Service (USFWS, 1980), the continued existence of the dwarf bearclaw poppy (Arctomecon humilis) would be threatened with the construction and operation

of the Warner Valley powerplant and water project; however, the silver cholla cactus (*Pediocactus sileri*) would not be significantly affected.

Habitat of the officially listed endangered woundfin minnow (*Plagopterus argentissimus*) would be adversely affected by the construction and operation of the proposed Warner Valley water project. A biological opinion concerning impacts to the fish was prepared by USFWS (April 3, 1978) which concluded that the proposed reservoir project would be in violation of the Endangered Species Act. The opinion also set forth certain minimum streamflows required to protect the woundfin minnow from extinction. In 1979 the Washington County Water Conservancy District submitted a redesigned diversion schedule in an effort to meet the minimum flows recommended by USFWS and their earlier proposal. As a result, BLM reinitiated Section 7 reconsultation on the project with USFWS to determine if the redesigned diversion structure would impact the woundfin minnow. A joint study by representatives of BLM, Utah Division of Wildlife Resources, and USFWS was undertaken in the summer of 1980 to obtain data regarding woundfin habitat requirements, habitat availability, and historical flows of the Virgin River. This information, used as a basis for the biological opinion issued by USFWS (October 1980), concluded that flow requirements necessary for the woundfin minnow would be more restrictive than estimated in the previous biological opinion, and if the project would be constructed as proposed, it would jeopardize the continued existence of the woundfin minnow.

USFWS has also prepared a biological assessment on the rare Virgin River roundtail chub (*Gila robusta seminuda*) and a biological opinion on the threatened (in Utah) desert tortoise (*Gopherus agassizii*). These assessments indicate that the proposed Warner Valley water project would adversely affect the roundtail chub, but the desert tortoise would not be significantly affected by construction of the slurry pipeline or the transmission lines. The USFWS biological assessment concludes that the impacts to the rare Virgin River roundtail chub would be similar to those of the woundfin minnow.

In accordance with the National Historic Preservation Act of 1966 (Section 106), a description of the proposed AWP energy system and its alternatives was sent on March 28, 1980 to the Western Division of Project Review of the President's Advisory Council on Historic Preservation. BLM, in cooperation with the State Historic Preservation Officer of Utah, has identified one existing property on the National Register of Historic Places which would be destroyed by the proposed project. This property is the Hurricane Canal/Diversion. The natural setting of the Honeymoon Trail, a property nominated for inclusion on the National Register of Historic Places, would be adversely affected with the construction of the coal slurry pipeline and ancillary facilities, and with the placement of the Warner Valley powerplant. In compliance with 36 CFR, Part 800, consultation with State Historic Preservation Officers and the President's Advisory Council on Historic Preservation is continuing.

The Dominguez-Escalante Trail is under study by NPS for inclusion in the National Historic and Scenic Trails System. The development of the Warner Valley powerplant would adversely affect the natural setting of a portion of this trail.



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

VIRGIN RIVER GORGE



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

COMMEMORATIVE WAGON TREK ON THE HONEYMOON TRAIL

Expansion of an existing communications facility on Spirit Mountain, Nevada would be offensive to several southwestern Indian tribes. Spirit Mountain (Avikwame) is considered the sacred place of creation for the Mojave, Quechan, Kamia, Diegueno, and Maricopa peoples of southern Nevada, western Arizona, and southeastern California.

Mining operations in the Alton east coal lease area would be a major visual intrusion on the landscape as viewed from Yovimpa Point in Bryce Canyon National Park. Blasting and noise associated with normal mining operations could impact recreation and aesthetic values in the park. Mine generated dust could impair the visibility of the view from Yovimpa Point across the mining areas by 5 to 25 percent. Present data indicates that wherever blasting would occur in the lease area it would be perceivable and probably distracting to visitors throughout the park at all times of the year.

According to an NPS visitor survey, strip mining would decrease the value of visits for approximately 20 percent of the annual visitors to Bryce Canyon National Park for the 21 years of visible mining.

A total of 24,752 acres would incur a change from existing uses to project uses over the life of the project. The following land use plans and controls would be affected by this alternative: a zoning change in Kane County to permit surface mining; a zoning change in Clark County, Nevada to permit the proposed Harry Allen powerplant; and zoning changes in Washington County to permit the proposed Warner Valley powerplant and water project. The routing of transmission lines through the incorporated city limits of Henderson, Nevada would require city council approval. Current routing of the 500-kV alternative transmission lines (except for the I-15 route) proposed for construction in southern California would pass through portions of Wilderness Study Areas. These areas are presently under an "interim management policy" designed to protect their wilderness values.

Substantial changes to the existing lifestyle, tax base, and socio-economic bases of Kane and Washington Counties, Utah, and Clark County, Nevada would occur as a result of project developments. A synopsis of the anticipated impacts is provided below by county.

Kane County. While providing increased employment and income opportunities in the county, this alternative would probably generate some major infrastructural and sociological problems. Increased incomes and expanded tax bases would be very beneficial for the county, but would have to offset added expenditures in such areas as law enforcement, sewage treatment, education, health care, etc. An equity between such benefits and burdens would probably not be achieved very rapidly.

Washington County. This alternative would provide Washington County with additional population and economic growth. This growth during the construction period could generate some temporary housing and sewage disposal problems in some of the affected communities. Expansion of the county's tax base should eventually relieve such problems, although some short-term deficiencies would probably be incurred.

Clark County. Since high population growth rates already exist in the Las Vegas Valley area and since there is a large diversity in employment and business activity, this alternative would not generate much impact on existing trends. The greatest impacts would occur during the construction phase of the project, but these would only yield 1 or 2-percent increases over baseline projections and could probably be absorbed by the area quite readily. The increased tax base could be extremely beneficial, especially in view of the low level of incremental impacts on existing services that would be generated by the project.

Coal-fired generating capacity (1,750 MW) equal to approximately 17.5 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the consumer would benefit from a more stable electricity costs structure.

Alternative 2: Construct a 2,000-MW Powerplant at the Harry Allen Site and Slurry Coal from the Alton Coal Lease Area

The information presented below focuses on anticipated impacts which would be substantially different from those discussed under Alternative 1. Because impacts would be essentially the same for air quality and visibility effects of the proposed Harry Allen powerplant, incremental use of the Class II PSD allowance, biological effects to the desert tortoise, impacts to recreation and aesthetics values in Bryce Canyon National Park, Wilderness Study Areas in southern California, Spirit Mountain (a native American religious site), and the socioeconomic effects to Kane and Clark Counties, the reader is referred back to the impact description for Alternative 1.

Because of the lower production rate, impacts to air quality and visibility would be similar but slightly less than impacts described under Alternative 1 for this resource.

The pumping of 8,000 acre-feet of ground water per year from the Navajo Sandstone formation near Alton, Utah could adversely affect nearby springs. The extent and severity of the possible impacts cannot be determined until an intensive program of test drilling and pumping is conducted. According to the State of Utah Department of Natural Resources, Division of Water Rights "approval [of the Alton well field] could not be made if there is known or even suspected interference possible [with approved water rights]."

According to a biological opinion prepared by USFWS, two officially listed endangered plant species would not be significantly affected by the construction of a coal slurry pipeline near the city of St. George. These species are the dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri).

BLM, in cooperation with the State Historic Preservation Officer of Utah, has identified an adverse impact to the Honeymoon Trail, a site nominated for National Register status. The coal slurry pipeline and its ancillary facilities would alter the natural setting adjacent to a portion of the trail. Prior to any project implementation the procedures outlined in 36 CFR, Part 800 will be followed.



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

SILVER CHOLLA CACTUS



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

DWARF BEARCLAW POPPY

A total of 17,351 acres would incur a change from existing uses to project uses over the life of the project. The following land use plans and controls would be affected by this alternative: a zoning change in Kane County to permit surface mining; a zoning change in Clark County, Nevada to permit the proposed Harry Allen powerplant; and the routing of transmission lines through the incorporated city limits of Henderson, Nevada would require city council approval.

Coal-fired generating capacity (1,400 MW) equal to approximately 14 million barrels of oil per year would be available for use in the service areas of NPC, SCE, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the electricity consumer would benefit from a more stable electricity costs structure.

Alternative 3: Construct a 250-MW Powerplant at Warner Valley with Coal Trucked from the Alton Coal Lease Area, Construct the Warner Valley Water Project, and Construct a 1,000-MW Powerplant at the Harry Allen Site with Coal Railed from Central Utah or Southwestern Wyoming

As indicated in Alternative 2, the following discussion focuses on those impacts which would be substantially different from those discussed under Alternative 1. For a discussion of the following impact areas, refer to the impact description under Alternative 1: utilization of a portion of the appropriate PSD class increments, cultural resource values, land use changes, and Wilderness Study Areas in southern California.

EPA Regions VIII and IX have not evaluated this alternative for compliance with air quality values. However, based on the screening procedures used by EPA for Alternative 1, it is estimated that emissions from the 1,000-MW Harry Allen powerplant would violate Class II standards in the vicinity of the powerplant if southwestern Wyoming or central Utah coal would be used. NPC and EPA are presently developing a modeling implementation plan for more vigorous analysis.

Information is not presently available on possible cumulative air quality impacts from a combination of the proposed Harry Allen powerplant and the Reid Gardner powerplant (with an addition presently under construction). The possible interactions must be determined before PSD and construction permit review procedures are completed.

Based on the EPA modeling for a 500-MW Warner Valley powerplant, no Class I or Class II standards would be violated by a 250-MW powerplant at Warner Valley.

According to the USFWS biological opinion (1980), off-road vehicle use, development of roads, and the powerplant and water project developments would threaten the continued existence of the dwarf bearclaw poppy (Arctomecon humilis); however, the siler pincushion cactus, (Pediocactus sileri) would not be significantly affected. USFWS reported in their official biological opinion (October 1980) that the development of the Warner Valley project as proposed in this alternative would jeopardize the continued existence of the woundfin minnow (Plagopterus argentissimus). USFWS has concluded that the threatened (in Utah) desert tortoise (Gopherus agassizii) would not be significantly impacted by the proposed project in this alternative. Also, USFWS (in

their latest biological opinion on the woundfin minnow, October 1980, has reported that the impacts to the rare roundtail chub (Gila robusta seminuda) would be similar to those of the woundfin minnow.

Although mining activities would not be directly visible from Bryce Canyon National Park, mine generated dust and noise could impact recreational and aesthetic values of Bryce Canyon National Park. Dust plumes would be visible from the park and present data indicates that wherever blasting would occur in the lease area, it could be perceivable and probably distracting to visitors throughout the park at all times of the year.

Hauling coal by truck from the Alton coal lease area to the 250-MW Warner Valley powerplant could result in 80 additional vehicle accidents over the life of the project.

A total of 19,096 acres (with the central Utah coal source) or 27,226 acres (with the southwestern Wyoming coal source) would incur a change in land use over the life of the project.

Substantial changes to the existing lifestyle, tax base, and socioeconomic bases of Carbon, Emery, Kane, and Washington Counties, Utah, and Sweetwater County, Wyoming would occur as a result of project developments. Substantial increases in the amount of tax base would also occur in Clark County, Nevada. A synopsis of the anticipated impacts is provided below by county.

Carbon and Emery Counties. Assuming central Utah coal would be used for the Allen powerplant, the expansion of the workforce attributable to the Allen project alone would blend together with the anticipated overall regional expansions. Lag time between the buildup of such a workforce, the demand for services, and the flows of tax revenues to the region's municipalities could be expected to precipitate some service failures and consequent declines in quality of life in the region. Overall, employment in the region would be expected to increase with the expansion of mining activities. This would, however, also increase the area's dependence on mining as an economic mainstay, making the region susceptible to major declines if mining activities would decrease in the future.

Sweetwater County. Assuming southwestern Wyoming coal would be used for the Allen powerplant, the effects of resulting workforce expansion would blend with the anticipated overall regional growth of around 15 percent between 1980 and 1985. This could be expected to generate some infrastructural problems for municipalities, especially in localized areas. Increased employment in the region would be highly beneficial, but would at the same time make the region more vulnerable to major economic declines if mining activities would decrease in the future.

Kane County. While this alternative would not provide for the maximum development of the Alton coal lease area, it would provide Kane County and its communities with relatively controllable growth. Additional demands would be placed on the existing infrastructure, but extreme hardships and difficulties would not be anticipated. Economic growth in the county would be moderate and the economy would remain relatively diversified, insulating it somewhat from the common "boom and bust" characteristic of mineral and energy development.

Washington County. As with Kane County, this alternative would provide Washington County with a more moderate and relatively manageable rate of growth. Some additional demands would be placed on local infrastructures. Most problems which might occur from such increased loads would be in the form of an aggravation of existing deficiencies rather than an infusion of new ones. The expansion of the county's tax base would be extremely beneficial and more than sufficient to offset any added infrastructural costs.

Clark County. Since high population growth rates already exist in the Las Vegas Valley area, and since there is a large diversity in employment and business activity, this alternative would not generate much impact on existing trends. The greatest impacts would occur during the construction phase of the project, but these would only yield about a 1-percent increase over baseline projections and could probably be absorbed by the area quite readily. The increased tax base could be extremely beneficial, especially in view of the low level incremental impacts on existing services that would be generated.

Coal-fired generating capacity (875 MW) equal to approximately 8.75 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the electricity consumer would benefit from a more stable electricity costs structure.

Alternative 4: Construct a 2,000-MW Powerplant at the Harry Allen Site with Coal Railed from Central Utah or Southwestern Wyoming

The information presented below focuses on anticipated impacts which would be substantially different from those discussed under Alternative 1. Because impacts would be essentially the same for cumulative air quality impacts of the Harry Allen powerplant, Spirit Mountain, Wilderness Study Areas in southern California, and socioeconomic impacts to Clark County, the reader is referred back to the impact description for Alternative 1. The reader is referred to the discussion of socioeconomic impacts under Alternative 3 for an evaluation of Carbon, Emery, and Sweetwater Counties because the impacts would be essentially the same.

EPA Region IX has not evaluated this alternative for compliance with air quality standards. Based on the screening procedure used by EPA for Alternative 1, it is estimated that emissions from a 2,000-MW Harry Allen powerplant would exceed the PSD Class II SO₂ and total suspended particulate increments if either central Utah or southwestern Wyoming coal would be used. The NAAQS SO₂ standards would be exceeded if southwestern Wyoming coal would be used.

EPA Region IX has approved an air quality model for more detailed analysis for the Harry Allen powerplant, which could be applied to this alternative. Information is not presently available on possible cumulative air quality impacts from the proposed Harry Allen powerplant, existing units of the Reid Gardner powerplant, and the portion of the Reid Gardner powerplant under construction. This issue must be resolved before the issuance of PSD construction permits for the Harry Allen powerplant.

A total of 15,196 acres (with the central Utah coal source) or 31,456 acres (with the southwestern Wyoming coal source) would incur a change from

existing uses to project uses over the life of the project. The following land use plans and controls would be affected by this alternative: a zoning change in Clark County, Nevada to permit the proposed Harry Allen powerplant; and the routing of transmission lines through the incorporated city limits of Henderson, Nevada would require city council approval.

Coal-fired generating capacity (1,400 MW) equal to approximately 14 million barrels of oil per year would be available for use in the service areas of NPC, SCE, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the electricity consumer would benefit from a more stable electricity costs structure.

Alternative 5: Energy Conservation and Alternative Energy Sources

Impacts that would be incurred with the implementation of this alternative in the participating utilities' service areas of the city of St. George, NPC, PG&E, and SCE primarily concern those to energy demand (consumption and peak demand) and socioeconomics. Impacts could also occur to several physical environmental elements, depending on the location and design of various projects.

Based on projections of peak energy demand, the implementation of this alternative would supplant the need for additional capacity for the city of St. George in the year 1990 if current generating capacity would be maintained. It would also reduce significantly the need for additional capacity in the year 2000.

Approximately 221 MW of peak energy demand would be displaced with the implementation of this alternative in the NPC service area in 1990. This would represent approximately 76 percent of NPC's initial capacity that would result from the AWV project for this timeframe. Full implementation of this alternative by the year 2000 would result in a reduction in peak energy demand of 485 MW. This would represent a surplus of 140 MW over and above NPC's projected capacity that would result from the AWV project in the year 2000.

The application of this alternative in the PG&E and SCE service areas would result in a surplus over and above the capacity represented by the AWV project for these utilities in 1991. This capacity could be used to further reduce energy demand and displace current oil-fired capacity in the California utilities' service areas. The reduction in total energy consumption would result in the lowering of overall energy costs to consumers.

The total capacity represented by energy savings and displacement in this alternative would be approximately 5,777 MW in 1991. If this capacity would be utilized to reduce oil-fired generation, it would be equivalent to approximately 58 million barrels of oil per year, and the electricity consumer would benefit from a more stable electricity costs structure.

The implementation of this alternative would generate the following socioeconomic impacts: possible increases in building capital costs from the installation of alternative energy sources and conservation components; some shifts and/or expansions in employment as alternative energy sources support industries come into existence; and changes in the patterns of energy use to

reduced consumption with possible related changes in current lifestyles (i.e., some sacrifices or "belt-tightening" in order to conserve energy).

Impacts could occur to the following physical environmental elements with the development of the alternative energy sources listed: air quality with cogeneration (including biomass) and geothermal developments; water resources with hydroelectric and geothermal developments, vegetation and wildlife with hydroelectric and cogeneration (biomass) developments; and land use with hydroelectric, geothermal, solar, and wind. Actual impacts would depend on the design and location of developments.

Alternative 6: No Action

The five southwestern Utah municipalities would have adequate domestic water supply capacities to meet the projected needs through the year 2000 without the Warner Valley water project. However it appears that there may be a deficit of storage capacity (water tanks) available to these municipalities, which could impact their ability to meet peak water demands in the summer months.

The city of St. George would continue its dependence upon an inadequate power transmission system, which could cause temporary restrictions on the ability of the city to attract industry and provide for community base expansion.

Should NPC be unable to purchase power from other sources, its customers may be subjected to power reductions (brownouts) during peak use periods.

SCE and PG&E would continue to rely on oil-fired generating facilities. A potential annual oil savings of about 14 million barrels would be foregone. The continued dependence on oil as an energy source would lead to an unstable powerplant fuel price structure and corresponding unstable electricity costs to the consumers.

UNRESOLVED ISSUES AND AREAS OF CONTROVERSY

Certain controversial issues which could have a direct bearing on the implementation of the applicants' proposal or alternatives have not been resolved. The following is a list of unresolved issues, the agency responsible, and the date by which the issue is expected to be resolved.

1. The Need For Power for the California Utilities. CPUC is expected to make a final decision by January 9, 1981 concerning the participation of the two California utilities (PG&E and SCE) in the AWV energy system in accordance with California State regulations.

2. Southern Utah Coal Unsuitability Petition. The Office of Surface Mining Reclamation and Enforcement (OSM) has been petitioned jointly by the Environmental Defense Fund, Sierra Club, Friends of the Earth, and Alton-area landowners to declare certain lands within the Alton coal lease area of southern Utah as unsuitable for all or certain types of mining (November 28, 1979). The petition alleges that reclamation following mining would not reestablish suitable vegetation cover, thus adversely affecting wildlife, soils,

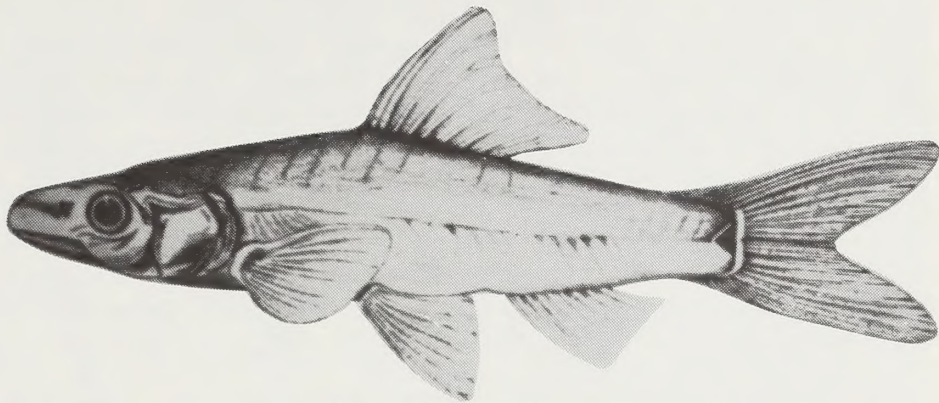
aesthetic values, and climatic conditions. The petition also alleges that mining operations would adversely affect Bryce Canyon National Park and Dixie National Forest through degradation of visibility, air quality, and scenic vistas, and that topographic formations in the park would be threatened to a degree that would be unacceptable. The petition further alleges that mining would result in a substantial loss or reduction of water supply and of food and fiber products in affected areas, and that alternative energy sources could provide a greater energy yield than the AWW energy system, which would probably be supplied by coal mining operations in the petition area.

The Secretary of Interior is expected to make a determination by December 1980 on the suitability of the Alton coal lease area for mining developments in accordance with the Surface Mining and Reclamation Act. Within the umbrella of the unsuitability petition are several specific issues which are under evaluation. OSM released its Southern Utah Petition Evaluation Document in draft form in September 1980. This NEPA style document analyzes the allegations of the Southern Utah Coal Unsuitability Petition of November 28, 1979. The analyses in this document support conclusions that revegetation reclamation could be successful, but that blasting noise and impairment of visibility would result in a short-term intrusion on the Bryce Canyon National Park recreation experience during active mining. The document also finds that pumping ground water from the Navajo Sandstone could affect, over the long-term, local water supplies and possibly diminish the flow of the Virgin River, which is habitat for the endangered woundfin minnow (Plagopterus argentissimus).

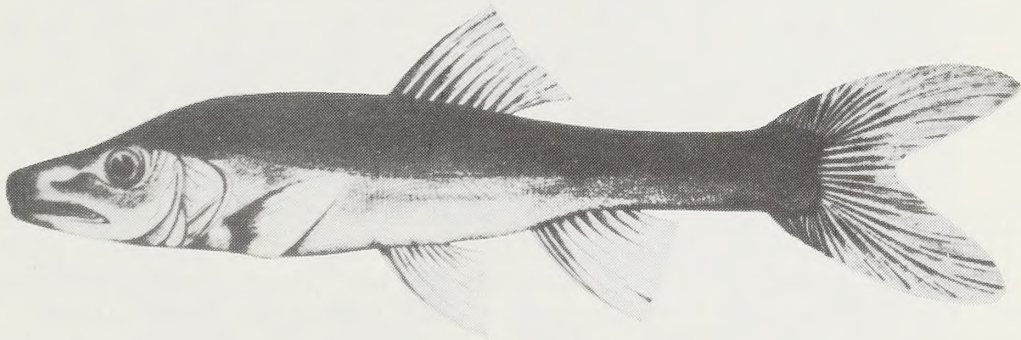
Various alternative actions, including conditional alternatives are analyzed. In general, the alternatives would lower the magnitude of adverse impacts to most resource values. However, some of these alternatives would also result in large tonnages of nonrecoverable coal. The Secretary will use the final Petition Evaluation Document as a basis for his decision.

3. Alton Mining Plan. Utah International Inc. must prepare a mining plan in accordance with any decision concerning the unsuitability petition (preceding section), and receive mining plan approval by OSM and U.S. Geological Survey (USGS) prior to project initiation. The Assistant Secretary of the Interior for Energy and Minerals approves life-of-mine mining plans based on the recommendation of the surface managing agencies (OSM and USGS). Once this approval has been made, OSM or an approved State regulatory authority under cooperative agreement may then approve a 5-year plan of operations, including appropriate recommendations from USGS. As part of this approval process, NPS, BLM, and the Forest Service (as Federal land managers) must make a determination and advise OSM of the acceptability of potential project impacts on unresolved issues, including blasting, air quality, visibility, visual intrusion, and water supply and quality. The Utah State Engineer will make a determination on whether or not to approve the Utah International, Inc., applications for ground water withdrawals for coal slurry transportation. This decision is expected in 1981. A mining and reclamation plan addressing the requirements of the 1977 Surface Mining Control and Reclamation Act is expected to be submitted in 1981.

4. Compliance With Air Quality Regulations. EPA is responsible for determining if any project related emissions or pollutants would be in violation of NAAQS or pollutant increments for Class I or Class II areas, and issue or



WOUNDFIN
(*Plagopterus argentissimus*)



ROUNDTAIL CHUB
(*Gila robusta seminuda*)

RARE FISHES OF THE VIRGIN RIVER

deny a PSD permit. If NPS demonstrates to EPA's satisfaction that emissions from this project would have an adverse impact on the air quality related values (including visibility) in Class I areas (Bryce Canyon and Zion National Parks) even though the impact would not exceed the maximum allowable increases for a Class I area, the permit may not be issued.

The issue of whether or not the project would have adverse impacts on air quality related values of the Class I areas has been the subject of several ongoing studies by NPC, EPA, NPS, OSM, Utah International Inc., and BLM. These studies have been incorporated into the OSM Southern Utah Petition Evaluation Document (1980) on unsuitability of the Alton coal lease area, presently undergoing public review. The EPA Region VIII proposed disapproval of the construction of the Warner Valley powerplant is in the public comment period, presently scheduled to last until November 1980. EPA Region IX has approved an air quality model for more detailed study of the Harry Allen powerplant.

EPA Regions VIII and IX are unable to commit to specific dates for completion of the PSD process at this time. However, Region VIII could have a final PSD permit decision by November 1980. Region IX could have a preliminary decision by December 1980.

The States of Utah and Nevada also have statutory roles in air quality and would have to issue permits before developments could begin operation in the respective States.

5. Cultural Values. BLM and the Utah State Historic Preservation Officer have determined that the construction of the proposed Warner Valley water project diversion dam would destroy a National Register property and have requested comments from the President's Advisory Council on Historic Preservation. Procedures for the protection of historic and cultural properties (36 CFR, Part 800) have not yet been complied with; however, these procedures will be followed before implementation of any one or parts of the alternatives.

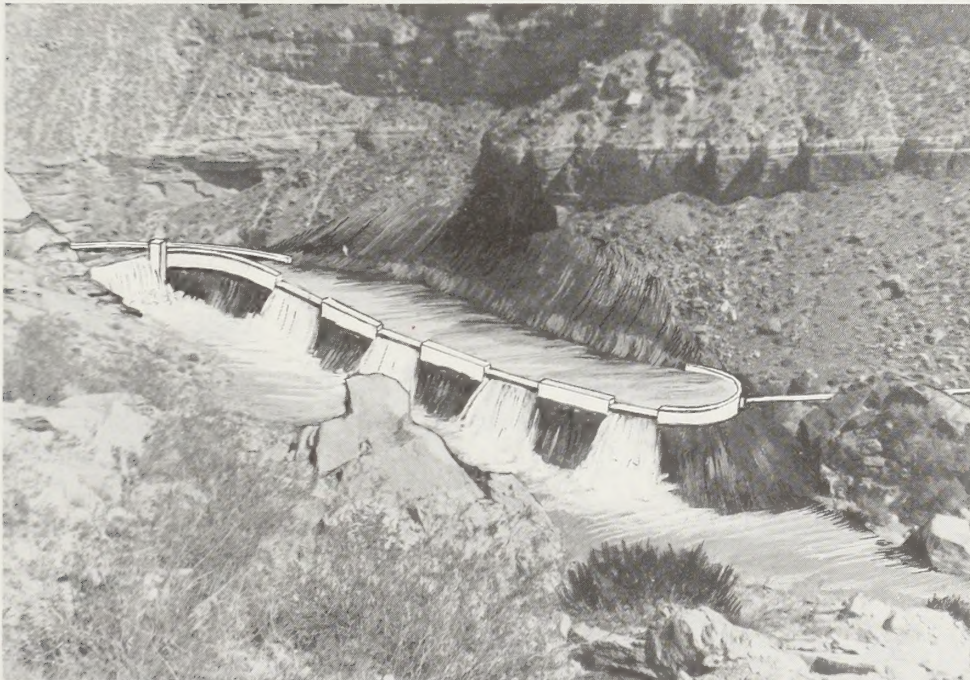
6. Floodplain Restrictions. Portions of the proposed Harry Allen powerplant site would be located within the 100-year floodplain of a playa in Dry Lake, Nevada. Potential flood hazards to the plant from a 100-year flood have not been determined in accordance with Executive Order 11988. The U.S. Army Corps of Engineers will analyze these hazards and report them to the Secretary of the Interior before a decision is made on this project.

7. Land Use Conflicts with Transmission Lines. The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or potential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. The routing of transmission lines through the incorporated city limits of Henderson, Nevada would require city council approval. Problems may also arise in the limitation or preclusion of future transmission line routing. The applicants, the appropriate land managers, and local and State governments would have to agree upon the final routing and design of the transmission system in order to minimize the impacts of crowding.



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

HURRICANE DIVERSION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

VISUAL SIMULATION OF PROPOSED HURRICANE DIVERSION

IDENTIFICATION OF THE BUREAU OF LAND MANAGEMENT PREFERRED ALTERNATIVE

The BLM preferred alternative is: the development of the Harry Allen powerplant and associated transmission lines at a capacity meeting State and Federal regulatory requirements in combination with energy conservation and alternative energy resources. The preferred alternative does not include development of the proposed Warner Valley powerplant, associated transmission lines and the proposed coal slurry pipeline, or the proposed Warner Valley water project as currently designed. The BLM preferred alternative would defer actions on the Alton well field and the coal slurry pipeline associated with the Harry Allen powerplant until the Utah State Engineer decides on the proponents' water right applications and until the Secretary of the Interior renders a decision on the unsuitability petition for the Alton coal field.

CHAPTER 1

THE PURPOSE AND NEED OF THE PROPOSED ACTION

INTRODUCTION

In accordance with the National Environmental Policy Act of 1969 (Public Law 91-190, 1970), the Bureau of Land Management (BLM), acting as lead agency, has prepared this document in response to the filing of rights-of-way applications by Nevada Power Company (NPC), Southern California Edison (SCE), Pacific Gas and Electric (PG&E), the Washington County Water Conservancy District, and the city of St. George for use of approximately 28,500 acres of public land. The applicants propose to utilize these public lands in southern Utah, Nevada, California, and northern Arizona to develop their proposed 2,500-megawatt (MW) Allen-Warner Valley (AWV) energy system.

This chapter identifies: the purpose and need of the proposed project; the scoping procedures which were used in determining the significant environmental impacts; the scope of this environmental impact statement (EIS); and interrelated projects which could have a cumulative effect.

PURPOSE AND NEED OF PROPOSED PROJECT

According to the applicants, the proposed energy project is designed to meet, at least in part, the need for increased electrical energy supplies (load growth) in the early 1990s and beyond for the participating utilities, and would help displace some of the oil which is now being used to generate electrical energy in the utilities' energy resources mix.

From the proposed AWV energy system the participating utilities have projected a need for the following generating capacities by 1990: NPC, 285 MW (NPC, 1975); SCE and PG&E, 1,045 MW each (SCE and PG&E, 1979); and the city of St. George, 43.7 MW (all of which would come from the AWV energy system; personal communication, Rudger McArthur, St. George City Utilities Director, May 27, 1980).

The ownership and initial electrical generating capacity entitlements of the participating utilities in the proposed Harry Allen and Warner Valley powerplants would be:

<u>Participants</u>	<u>Ownership</u>	<u>Initial Capacity Entitlement</u>
<u>Harry Allen Powerplant</u>		
Nevada Power Company	20%	8% (160 MW)
Southern California Edison Company	40%	46% (920 MW)
Pacific Gas and Electric Company	40%	46% (920 MW)
<u>Warner Valley Powerplant</u>		
Nevada Power Company	25%	25% (125 MW)
Southern California Edison Company	25%	25% (125 MW)
Pacific Gas and Electric Company	25%	25% (125 MW)
City of St. George	25%	25% (125 MW)

Initially, NPC would obtain 8 percent of the output from the Harry Allen powerplant. However, 13 years after the inservice date of the first unit of the powerplant, NPC could recapture capacity from SCE and PG&E in annual increments (with limits) to supply the electrical energy needs of its customers. Ultimately, 100 percent of the Harry Allen powerplant output would stay in the southern Nevada area (NPC, 1975).

The question - "Is the power really needed?" - was raised numerous times during the EIS scoping process. In order to better respond to this question, the initial entitlements as listed above were subject to verifications independent of the participating utilities. The years 1990 for the NPC and St. George service areas and 1991 for the California utilities are used as a basis for energy need comparisons because the four utilities have indicated need projections for these dates.

NPC projected an electrical energy need of 285 MW by 1990, which was accepted by the Nevada Public Service Commission (letter of January 23, 1980). An independent verification by a BLM contractor indicates that NPC would indeed need this initial capacity of 285 MW in 1990.

The California Public Utilities Commission (CPUC) is conducting a proceeding on an application filed by SCE and PG&E for a Certificate of Public Convenience and Necessity for the AWV energy system. CPUC's Allen-Warner project team has reviewed the proposed project, the needs it might serve, and alternatives to it, and based on results of analyses as purported in the draft Environmental Impact Report (EIR) (CPUC, 1980) and the "Summary Report of the Allen-Warner Project Team: A Planning Strategy for Electric Supply for PG&E and SCE" (CPUC, 1980), the team presented the following conclusions and recommendations to the Commission:

1. Each applicant should be granted a Certificate of Public Convenience and Necessity for participation in up to 920 MW at the Harry Allen powerplant, either in full ownership or in ownership and layoff rights during the early years of plant operation. The certificate should specify that the plant will not be designed to use coal from the Alton lease area, but rather a high heat content, relatively low moisture and low sulfur content coal; as part of this specification, the design heat rate of the units should be no more than 10,500 Btu/kWhr, which would be accommodated by coal sources other than the Alton lease area, and the station certificate should include facilities for handling coal brought by rail but no facilities (such as dewatering facilities) for handling coal delivered by slurry pipeline.

2. No certificate should be issued for the Warner Valley powerplant.

3. The program for development of nonconventional resources as specified in the "Summary Report" should be implemented as a start to realization of the alternatives development scenario (contained therein) and the specific measures outlined in the "Summary Report" should be incorporated into the order in this proceeding.

4. The program for cost and schedule monitoring proposed should be implemented to help assure that the Harry Allen powerplant will be built in a reasonable time and at a reasonable cost. The cost and schedule measures proposed by the CPUC project team should be incorporated into the order in this case and be made a condition of the certificate.

5. The transmission line route recommendation contained in the "Summary Report" (the I-15 corridor) and the transmission line survey monitoring and construction programs proposed therein should be adopted. These measures should be incorporated into the order and made a condition of the certificate.

The CPUC project team further explained that the capacity that would be represented by the Harry Allen powerplant should be made available to PG&E and SCE "for purposes of reducing the amount of oil burned in California for power generation (the 'oil displacement' need)," but that it is not needed for maintaining reliability of electric service ("Summary Report," 1980).

The California Energy Commission (CEC) was authorized intervention in the CPUC proceeding, and on May 21, 1980, the CEC tentatively determined that current utility plans contain sufficient preferred resources that, if constructed, they would reduce PG&E's need for power from the AWV energy system to 498 MW, but the need for SCE would be at least its proposed share (1,045 MW). A final determination on whether preferred resources in the plans of PG&E and other northern California utilities can in fact be relied upon to displace all but 498 MW of PG&E's share of the AWV energy system will be deferred to the filing of briefs after all parties have had an opportunity to testify on the viability of the preferred alternative (personal communication, Dave Marcus, representative of CEC, May 22, 1980). The commission determination was updated on July 16, 1980 in oral testimony at the CPUC proceedings for a Certificate of Public Convenience and Necessity for AWV by David Marcus of CEC. The updated determination incorporates the most recent PG&E and SCE resource plans. The substantive difference in the updated determination is that PG&E would need only 483 MW instead of 498 MW of the capacity represented by AWV, and SCE would still need at least its proposed share (1,045 MW).

The Public Service Commission of Utah was asked for an opinion on the future power needs of the city of St. George. The Commission indicated that it does not have jurisdiction over the municipal utility and that decisions relating to power needs are the responsibility of the elected and utility officials of St. George (personal communication, Milly Bernard, Chairperson, Utah Public Service Commission, September 6, 1980). Independent BLM assessments indicate that the city of St. George would need 10 MW of the 125 MW of capacity that would be made available from the proposed AWV energy system by 1990 (assuming a 15-percent reserve margin). This assessment is based on a projected population of 17,746 in 1990 (3.6 percent annually compounded growth rate).

According to the applicants, while the proposed Warner Valley water project would provide cooling water to the proposed Warner Valley powerplant and supply supplemental irrigation water, most of the water from this facility would be used for culinary purposes in five southern Utah communities and for unspecified local projects of the State of Utah. The State of Utah has identified this project for possible State funding should alternate financing become necessary. According to the Washington County Water Conservancy District (Memorandum from Rudger McArthur, Secretary-Treasurer, December 6, 1979) the water project would provide, at full operation, some 26,200 acre-feet of fully treated culinary water. This amount of water would be sufficient to supply culinary and industrial water to a city of about 52,000 people, based on the assumed need of 450 gallons per person per day (Chalmers

and Anderson, 1977). According to Conservancy District projections, culinary water deliveries would start as soon as water would be impounded and treatment facilities constructed.

According to a recent BLM-sponsored study, however, the proposed water supply system would not be needed for municipal and industrial (culinary) uses through the year 2000 (BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980). The study indicates that with the recently completed Snow Canyon Water Project located northeast of St. George, the following municipal water supply/demand situation would exist by the year 2000:

<u>Water User</u>	<u>Demand in the Year 2000 (Percent of Present Capacity)</u>
St. George including Bloomington (assuming an annual compounded growth rate of 3.6%)	89
Santa Clara (assuming an annual compounded growth rate of 1.9%)	78
Ivins (assuming an annual compounded growth rate of 3.4%)	88
Washington (assuming an annual compounded growth rate of 2.4%)	90
State of Utah (no proposed use)	Not applicable

According to the forecasts, the municipalities' present water supply capacities would be adequate to meet the projected needs through the year 2000. It appears that there may be a deficit of storage capacity (water tanks) available to these municipalities, which could impact their ability to meet peak water demands in the summer months. According to the Soil Conservation Service (personal communication, Verle Smith, Richfield Area Conservationist, Soil Conservation Service, September 23, 1980), there is an agricultural water supply deficit during July and August of most years in the St. George/Washington Fields area, although the Soil Conservation Service does not have the data to quantify the deficit. The Soil Conservation Service states that: "Any project that would increase the amount of water available during the periods of deficit could increase the production of the farms served and would be agriculturally beneficial to the area." From this assessment it would appear that there would be a need for a portion of the capacity represented by the proposed Warner Valley water project for supplemental irrigation water for farms in the St. George/Washington Fields area.

SCOPING PROCESS

In accordance with the National Environmental Policy Act of 1969 (as amended) and the implementing regulations of the Council on Environmental Quality (Federal Register, Volume 43, Number 230), a notice announcing a series of EIS scoping meetings was published in the Federal Register on June 14, 1979 (Volume 44, Number 116). Four EIS scoping meetings were held during July and August 1979 in Las Vegas, Nevada; St. George, Utah; Kanab, Utah; and Salt Lake City, Utah. A written invitation was sent to all parties who had

expressed an early interest in the project, together with media releases designed to inform the general public. Approximately 335 people attended one or more of the scoping meetings and provided guidance in terms of defining the scope and level of detail in the EIS.

Each person attending a scoping meeting was requested to complete a scoping meeting form designed to document public input (Appendix 1). This form called for the listing of at least five topics which the participant believed should be addressed in the EIS. A numerical value was assigned to all of the topics listed, starting with 6 points for the most important issue or topic, 5 points for the next most important, etc. The fifth and all other topics listed were given 1 point each. After tabulating all of the scoping meeting rating forms the following results were obtained:

<u>Issue</u>	<u>Numerical Rating</u>
Hydrological Impacts	1,375
Socioeconomics	1,009
Air Quality (Including Visibility as it Relates to Zion and Bryce Canyon National Parks)	631
Need for Energy	329
Land Use Impacts	203
Future Situation Without Project	146
Impacts of Mining in the Alton Coal Lease Area	116
Threatened or Endangered Species	115
Aesthetics	110
Wilderness Values	86

The 335 scoping meeting participants were also asked to identify at least two possible alternatives to the proposed AWW energy system. Forty-six possible alternatives were suggested by the participants. In order to determine which of the suggested alternatives should receive an in-depth evaluation in the EIS, a set of alternative screening criteria was developed and used to determine the "reasonableness" of the 46 suggested alternatives. An alternative was considered to be reasonable if it met all of the screening criteria (Appendix 2). The following six alternatives (including the applicants' proposal) were determined to be reasonable and suitable for a detailed evaluation within this EIS. It is recognized that any one or parts of the six alternatives could be included in the eventual selection of a preferred alternative. Therefore, components under one alternative may be interchanged with components of another (e.g., any of the coal sources could be used by a powerplant). These reasonable alternatives, as listed below, are fully described in Chapter 2.

1. Construct a 500-MW powerplant in Warner Valley, a 2,000-MW powerplant at Dry Lake, Nevada, slurry coal from the Alton coal lease area, and construct the Warner Valley water project (applicants' proposal).

2. Construct a 2,000-MW powerplant at the Dry Lake, Nevada site and slurry coal from the Alton coal lease area.
3. Construct a 250-MW powerplant at Warner Valley with coal trucked from the Alton coal lease area, construct the Warner Valley water project, and construct a 1,000-MW powerplant at the Dry Lake, Nevada site with coal railed from central Utah or Wyoming.
4. Construct a 2,000-MW powerplant at Dry Lake, Nevada with coal railed from Wyoming or central Utah.
5. Energy conservation and the development of alternative energy sources.
6. No action.

Railroad as an Alternative Coal Transportation System

The alternative of building a railroad into the Alton coal lease area in order to link it with existing trackage leading to the Harry Allen powerplant site, and of building a spur railroad to the Warner Valley powerplant site was suggested during the four scoping meetings. Even though this alternative was examined during the scoping process and was found to be unacceptable on economic and energy efficiency grounds (see Screening Matrix, Appendix 2), the alternative was re-examined after several commentors (including the Kane County Commission; Letter 104; and the State of Utah, Letter 123) reviewed the draft AWW EIS and expressed renewed concern.

The development of a railroad system into southern Utah for the development of other coal fields (i.e., Kaiparowits), and the development of other resources (e.g., timber, petroleum, uranium, and other resources) would make the development of the Alton coal lease area with rail transport economically feasible. The development of a railroad system into southern Utah has long been discussed by State and local governments, and by Federal regulatory agencies. However, no such proposal has been set forth by the railroad industry, holders of the coal leases, timber interests, or any other party willing to undertake the project.

A regional rail system would involve complete project proposals, intensive engineering and environmental investigations, and economic feasibility studies. The actual construction of such a system could not take place prior to 1990 because of the required studies, permits, leases, etc., putting any such proposal outside the timeframe indicated for the proposed AWW energy system. The applicants' proposal is to have the Alton coal lease area in production by 1984.

The State of Utah, in cooperation with BLM and National Park Service (NPS), sponsored the Kaiparowits Coal Development and Transportation Study, which was released August 1, 1980 (ERT). The study does not evaluate specific proposed actions, but summarizes the potential environmental impacts of various modes of coal development and transportation from the region towards potential markets. Also, Union Pacific completed the "Southern Utah Rail Study" (1977) concerning the feasibility of a railroad to the Kaiparowits coal fields. A multiple use regional rail system would need to haul the

equivalent of 30 to 50 million tons of coal per year to be economically viable (draft Southern Utah Petition Evaluation Document [SUPED], OSM, 1980). Production of Alton and Kaiparowits coal fields could produce up to an estimated 84 million tons of coal per year, depending on environmental mitigation, making a regional rail system viable from a purely economic standpoint (ERT for BLM, 1980). Marketing of up to 50 million tons per year by 1993 was assessed by Morrison-Knudsen, Inc., as being highly probable (Southern Utah Railroad Project, 1978).

An additional use could be 85 to 90 million board feet of lumber per year from Kaibab Industries (personal communication, Carl Farnsworth, Kaibab Industries Representative, September 10, 1980). The potential also exists for the movement of oil and gas via rail, but volume of use is unknown since these resources are not currently developed. There is also limited production of uranium, with additional exploration ongoing. However, this ore is currently being shipped for processing to Blanding, Utah, east of the study site. Even with the existence of a rail system, Blanding would probably continue to be the destination for the unprocessed uranium.

Sales of livestock from Kane and Garfield Counties is approximately 13,000 head per year (U.S. Department of Commerce, Bureau of the Census, 1977). Currently the livestock is trucked to Cedar City and Salina for sale. This would be another potential user of a rail system.

These other potential uses, however, are minor and would not by themselves support a regional rail system. Any regional rail system to be considered under current economic conditions would be dependent on the development of the Kaiparowits coal fields. Currently there is no proposal to develop the Kaiparowits coal fields, nor is there a proposal for construction of a regional railroad before any regulatory agency. A railroad is therefore not considered a reasonable alternative for transporting Alton coal to proposed markets (powerplants) and is not considered in further analysis in this EIS.

Scope of the EIS

The AWV EIS provides an analysis of the proposed AWV energy system and its reasonable alternatives. In accordance with the guidance provided by the Council on Environmental Quality Regulations of 1978 and based upon public input noted under Scoping Process, this EIS is designed to focus primarily on significant impacts associated with hydrology, socioeconomic changes, and air quality. Discussions are also provided concerning cultural resource values, threatened and endangered species, land use changes, aesthetic values, energy efficiency, and wilderness impacts.

Environmental elements not identified as being of major public concern nor considered significant by the technical specialists preparing this document are given substantially less emphasis. These elements include: climate, fugitive dust, topography, geology, paleontology, minerals development, soils, and commonly occurring species of vegetation and wildlife.

Impact analyses focus primarily on the proposed powerplants, transmission systems, and coal transportation systems of the applicants' proposal and the alternatives. Impacts of coal mining for the different coal sources are

generalized with reference to previously published EISs which concern the specific coal mining regions.

Although scoping meeting responses urged an intensive evaluation of the Alton coal lease area, such an evaluation is not included in this analysis. The AWV project is one of several proposed energy developments discussed in Development of Coal Resources in Southern Utah Final Environmental Statement (SU) (USDI, USGS, 1979). This regional environmental statement provides analyses of the cumulative and general impacts of developing the AWV energy system, including development of the Alton coal lease area of southern Utah (Volume 2, Site-Specific Analysis). It also discusses the anticipated impacts of developing just the western half of the Alton coal lease area (Alton west) with a 1-million ton annual production rate.

An environmental analysis of proposed mining at the Alton lease area is also included in the draft SUPED (USDI, OSM, 1980). The analysis is provided as part of the process required under the Surface Mining Control and Reclamation Act of 1977 to answer a petition of unsuitability. Environmental analyses in SUPED include those concerning air quality and visibility, visual resources, surface and ground water, blasting effects including noise, and the impacts of underground mining. The findings of these analyses are summarized where they pertain to AWV, and are further referenced to SUPED. Recently the applicants have expressed interest in strip mining coal in the Alton lease area down to the 200-foot overburden depth. If implemented, such a plan would increase the total amount of coal to be surface mined to 295 million tons over the life of the project. The acreage affected would increase from 8,328 acres (150-foot overburden depth) to approximately 12,000 acres (200-foot depth). The coal development scenario analyzed in SUPED differs from that used in the AWV EIS in that it considers the impacts of surface mining to the 200-foot overburden depth.

Because no mining plan has been submitted by the applicants, actual areas to be affected, mining techniques, manpower figures, etc., are not considered final and are subject to change depending on a submitted mining plan and the decisions concerning SUPED and the petition evaluation being carried out by the Office of Surface Mining Reclamation and Enforcement (OSM).

The AWV EIS is therefore based on the most recent comprehensive information submitted by the applicants (Environmental Assessment, NPC, 1975) and is updated where necessary to insure as complete an environmental analysis of the proposed mining of the Alton coal lease area as practical.

The general environmental impacts that would occur from expansion of coal mining in central Utah and southwestern Wyoming are addressed in Development of Coal Resources in Central Utah Final Environmental Statement (CU) (USDI, USGS, 1979) and Development of Coal Resources in Southwestern Wyoming Final Environmental Statement (SW) (USDI, BLM, 1978) respectively. Material presented in the "high level production scenario" of CU includes analysis of the production of coal for unspecified markets, which could include the coal needs of the AWV energy system. Use of southwestern Wyoming coal would involve the expansion of coal mining over and above the level specified in the "high level production scenario." The analyses of impacts of coal mining in the proposed Alton coal lease area and the alternative coal sources in

central Utah and southwestern Wyoming are summarized or simply referenced from these previously published statements in accordance with the concepts of "tiering" and "incorporation by reference" contained in the Council on Environmental Quality Regulations of 1978. Under the principle of "incorporation by reference," these and several other publications are extensively utilized throughout this EIS. (Appendix 3 contains a list of Government Depository Libraries where public reading copies are available for review.) In addition, certain specific actions associated with complete development of the applicants' proposal or the alternatives (i.e., borrow areas, construction activities, camps, etc.) are not addressed because they would be subject to more detailed evaluations as onsite engineering takes place for the alternative finally selected for implementation.

A detailed mining plan for proposed development of the Alton coal lease area has not yet been submitted to the U.S. Department of the Interior, OSM. Should a mining plan be submitted to OSM, it would be subject to a technical and environmental review by that office. This review would be in accordance with the National Environmental Policy Act of 1969 (as amended) and would be subject to public review and a comment period as required under Section 513 of the Surface Mining Control and Reclamation Act of 1977.

A petition requesting OSM to designate certain lands in the Alton coal lease area of southern Utah as unsuitable for surface coal mining operations is presently before OSM (Environmental Defense Fund et al., 1979). The Secretary of the Interior must make a decision in early December 1980 as to whether or not certain lands will be designated unsuitable for all or certain types of mining, and will decide on stipulated conditions to any coal mining activities in the area covered by the petition. Some of the reasons cited by the petitioners for designating the lands unsuitable are: strip mined lands would not be reclaimable; accelerated erosion would cause increased sedimentation in surface streams; shallow ground water resources would be seriously degraded; springs and wells in the area could be adversely impacted; blasting could destroy the delicate erosional features of Bryce Canyon National Park; fugitive dust and pollutants from coal mining activities would impair air quality and visibility; and mining activities would be visible from Bryce Canyon National Park. Should the Secretary designate lands in the Alton coal lease area as unsuitable for mining, then no new mining permits would be granted on those lands, nor would any new leases be granted. If the Secretary sets conditions on mining in the Alton area, any level of coal development in the Alton lease area could be affected. OSM issued an environmental assessment in draft form in September, 1980 (USDI, SUPED). The final document will be used as a basis for the Secretary of the Interior's decision in regards to this petition.

In July 1980, the CPUC Allen-Warner project team issued their draft EIR on the proposed AWV energy system, which focuses primarily on the environmental impacts of the Western Transmission System, and on the purpose and need of the AWV project for the participating California utilities. This draft EIR was prepared in response to the filing of an application for a Certificate of Public Convenience and Necessity (a-59308), and addresses proposed and alternative transmission line routes, the feasibility, economics, technical characteristics and reliability of the entire project; and impacts in California related to the proposed project and alternatives including Energy Conservation and Alternative Energy Sources. A final decision on the

application is due by January 9, 1981. In September 1980, the project team released their "Summary Report: A Planning Strategy for Electric Supply for PG&E and SCE." The information provided in the EIR and "Summary Report" updates that provided by CPUC for use in the AWV draft EIS concerning the purpose and need of the project, and the information used in the analysis of Alternative 5 of this EIS (Energy Conservation and Alternative Energy Sources) for the participating California utilities. To obtain a copy of this document the reader should contact CPUC at the following address:

California Public Utilities Commission
Allen-Warner Valley Project
1390 Market Street
Fox Plaza, Room 724
San Francisco, California 94102

INTERRELATED PROJECTS

The Secretary of the Interior must make a decision in order to answer the Southern Utah Unsuitability Petition by early December 1980. OSM has prepared a draft environmental assessment of the possible impacts of mining certain lands in southern Utah as required under Section 522 of the Surface Mining Control and Reclamation Act of 1977. This assessment was released in draft form in September 1980 (SUPED, USDI, 1980). The petition, the petition process, and the environmental assessment are discussed in the preceding section in this chapter, Scope of the EIS.

NPC's Reid Gardner generating station is located about 25 miles northeast of the proposed Harry Allen powerplant site. The Environmental Protection Agency recently granted NPC a Prevention of Significant Deterioration permit to expand the station to 580 MW. Emissions from this facility and from the proposed Harry Allen powerplant could have a cumulative effect on the air quality of southeastern Nevada. These effects are assessed in the Air Quality section of Chapter 4 in this volume.

In December 1979, the Intermountain Power Project (IPP) was approved for development on public lands by the Secretary of the Interior. One of the transmission lines (230 kV) from the generating station could extend to the city of St. George, Utah. It is probable that electrical energy from this facility could be made available to the city of St. George. The IPP transmission line network and alternative routes, which will extend from the powerplant in Lynndyl, Utah through southern Nevada and into southern California, are extensively discussed in the final EIS for IPP (USDI, BLM, 1979). These same transmission line routes would be proposed as possible routes for the AWV energy system's southern California electrical transmission line network and are discussed only briefly in this EIS.

SCE and PG&E have both recently announced their intention to develop coal-fired power generating stations within the State of California. These generating stations would be in the 1,500 to 1,600-MW range. Planning for these generating stations may have a bearing on the purpose and need for electrical energy from the AWV energy system. These proposed powerplants are discussed in the analysis of Alternative 6 (No Action) in Chapter 4.

The U.S. Air Force is studying several valleys within eastern Nevada and western Utah for the siting of the proposed MX missile system. A draft EIS is scheduled for public release in 1981. The construction and operation of the MX missile system and the AWV energy system could have a cumulative effect on the socioeconomic environment of Nevada and Utah. These cumulative impacts cannot be analyzed until the release of the Air Force EIS and should be covered in that document.

The Federal Energy Regulatory Commission and BLM are lead agencies in the preparation of an EIS for a proposed natural gas pipeline system. The Rocky Mountain Pipeline would begin at Sage, Wyoming, run south to southwestern Utah, pass through southern Nevada, and connect with an existing PG&E pipeline in southwestern California. The proposed route of the pipeline could conflict with proposed transmission lines and the coal slurry pipeline of AWV. These possible impacts will be discussed in the Rocky Mountain Pipeline Project EIS, currently under preparation by BLM. The draft EIS is scheduled for public release in February, 1981.

Las Vegas Wash is being studied by Clark County Parks and Recreation and the Comprehensive Planning Departments for the potential development of a wetlands park. An environmental analysis is being conducted to analyze the complex problems affecting the wash that will influence eventual development of recreation facilities and uses. Following the environmental analysis and public input on the alternatives developed, a detailed master plan will be prepared by Clark County. The Rainbow Gardens area is also under consideration as a possible part of this park, but specific planning on this has not been developed by Clark County.

LaVerkin Springs is located on the Virgin River about 2 miles downstream of the proposed point of diversion for the Warner Valley water project. The Water and Power Resources Service proposes to capture the discharge of the spring and remove approximately 95 percent of the salts from this highly saline water source. A 70-percent reverse osmosis process would be utilized to treat the saline spring water. Approximately 6,000 acre-feet of processed water would be either returned to the Virgin River or made available for other uses. Should this project be developed at the same time as the AWV energy system, the anticipated socioeconomic effects of the AWV energy system would be intensified in Washington County, Utah. The saline waters from this and other sources along the Colorado River system could have potential use in coal slurry pipelines or as powerplant cooling waters.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter presents a description of the applicants' proposal and the five alternatives to that proposal found to be reasonable through the alternative selection process (Scoping Process, Chapter 1). A discussion of actions needed to authorize the implementation of the applicants' proposal or alternatives, a discussion of standard operating procedures and mitigating measures required to receive approval to utilize public lands, a comparative summary of the impacts of the applicants' proposal and the five alternatives, and the Bureau of Land Management (BLM) preferred alternative are also included.

ALTERNATIVE 1: APPLICANTS' PROPOSED ACTION

This alternative would involve the construction and operation of a 2,500-megawatt (MW) coal-fired steam-electric generating system. The system would consist of a coal mine, a coal processing facility, a coal slurry pipeline system, two separate powerplants, a water reservoir project, and an electrical transmission system. Projected life would be 40 years (although the water project itself would have a life of as much as 100 years or more). Figure 2-1 (located at the back of this volume) indicates the location of the various components of the system. Table 2-1 provides a summary of the requirements of land, water, fuel, manpower, etc. under this alternative. The distribution of ownership of lands proposed for development is shown in table 2-2. A full description of design features of the applicants' proposal can be found in Allen-Warner Valley Energy System: Environmental Assessment (Nevada Power Company [NPC], 1975). Following is a brief description of the major components of this alternative.

Coal Mine

The applicants have proposed the Alton coal lease area of southern Utah as their preferred coal source. As proposed, a new coal mine would be opened in the Alton coal lease area (about 25 miles north of Kanab, Utah) to provide coal for this alternative (fig. 2-2). Existing Federal and State coal leases and private lands would be developed to produce about 312 million tons of coal over the 40-year project life. Coal would be produced by both surface and underground mining methods. The average quality of the Alton coal (as mined) would be 9,647 British thermal units per pound (Btu/lb), 1.11 percent sulfur, and 9.35 percent ash. Average quality (as fired) would be 8,897 Btu/lb, 0.86 percent by weight of sulfur, and 7.19 percent by weight of ash (NPC, 1975). The total mined area would be about 8,328 acres (including underground mining area).

As proposed by the applicants, the surface mine would yield about 212 million tons of coal. Dragline strip mining methods would be used to develop a 35-mile long intermittent coal outcrop through a contour strip mining operation. Approximately 300 to 400 acres would be disturbed annually as mining would proceed.

TABLE 2-1

Alternative 1 - Resource Requirements (Daily Averages)

Project Components	Land ^a (acres)	Input					Output					Wastes			
		Water (acre-feet)	Coal ^b (tons)	Electricity ^c (MW)	Oil (barrels)	Lime (tons)	Manpower (workers)	Water (acre- feet)	Coal ^b (tons)	Electricity ^c (MW)	Solids (tons)	Liquids (acre- feet)	Emissions (tons) ^d		
													SO ₂	TSP NO _x	
ALTON COAL MINE															
Construction	.....	.....	.....	.....	.....	...	85	.....	f.....	.....	.....	.....	.....	.....	.....
Operation	8,328	0.65	.....	24.6	.....	...	1,050	.....	31,951	.....	.....	.....	.....	.....	.....
COAL PREPARATION PLANT															
Construction	.....	.....	.....	.....	.....	...	350	.....	.....	.....	.....	.....	.....	.....	.....
Operation	1,826	26.5	31,951	25.4	.....	...	50	22.69	28,532	.....	3,419	.....	.....	.....	.....
WARNER VALLEY POWERPLANT															
Construction	.....	0.07	.....	.....	.....	...	1,000	.....	.....	.....	.....	.....	.....	.....	.....
Operation	4,295	15.9	5,663	.....	65.23	156	100	.....	.....	350	1,207	1.4	10.38	2.04	34.3
WARNER VALLEY WATER PROJECT															
Construction	.....	.....	.....	.....	.....	...	150	.....	.....	.....	.....	.....	.....	.....	.....
Operation	2,993	162.0	.....	.....	.....	...	5	99.45	.....	.....	.....	.....	.....	.....	.....
HARRY ALLEN POWERPLANT															
Construction	.....	0.35	.....	.....	.....	...	2,000	.....	.....	.....	.....	.....	.....	.....	.....
Operation ^g	5,887	64.97	22,869	.....	260	302	300	.....	.....	1,400	3,398	0.57	40.8	8.16	136.22
COAL SLURRY PIPELINE															
Construction	2,218	.....	.....	.....	.....	...	300	.....	.....	.....	.....	.....	.....	.....	.....
Operation	1,000	22.69	28,532	0.7	.....	...	60	22.69	28,532	.....	.....	.....	.....	.....	.....
ELECTRICAL TRANSMISSION SYSTEM															
Construction	11,434	.....	.....	.....	.....	...	200	.....	.....	.....	.....	.....	.....	.....	.....
Operation	423	.....	.....	.....	.....	...	10	.....	.....	.....	.....	.....	.....	.....	.....

Source: Based on information submitted by NPC, 1975; Washington County Water Conservancy District, 1975

^a Acreage computed on a 40-year project life.^b Tonnage of all coal computed as having a moisture content of 25.23 percent.^c Figures represent capacity. Daily use on production of electricity would be these figures multiplied by 24 (24 hours).^d Emissions tonnage includes sulfur dioxide (SO₂), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices. Emission rates are based on maximum operating capacity.^e Coal mine work force would build over 10-year period.^f Daily average coal production computed from an average operation of 80 hours per week.^g Powerplant operation computed at 70-percent capacity.

NOTE: MW = megawatts

TABLE 2-2

Alternative 1
Land Ownership of Acreage Affected

Component	Affected Acreage	Land Ownership (Percent of Total Acreage)		
		Public	State	Private
Alton Coal Mine	8,328	78.0	3.4	18.6
Coal Preparation Plant	1,826	32.0	0.0	68.0
Coal Slurryline	2,218	77.0	11.5	11.5
Warner Valley Powerplant	4,295	84.5	15.0	0.5
Warner Valley Water Project	2,993	68.0	23.0	9.0
Harry Allen Powerplant	5,887	98.6	0.0	1.4
Electrical Transmission System				
Spry to Alton	815	38.5	7.5	54.0
Warner to St. George	46	70.0	30.0	0.0
Warner to Pecos	1,975	86.7	11.7	1.6
Allen to Eldorado	1,598	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	7,000	68.0	2.0	30.0
Eldorado-Lugo	7,400	73.0	0.0	27.0
Victorville- McCullough	7,160	73.0	0.0	27.0
Highway 66	9,520	73.5	0.2	26.3

Source: NPC, 1975; Washington County Water Conservancy District, 1975; SCE and PG&E, 1979

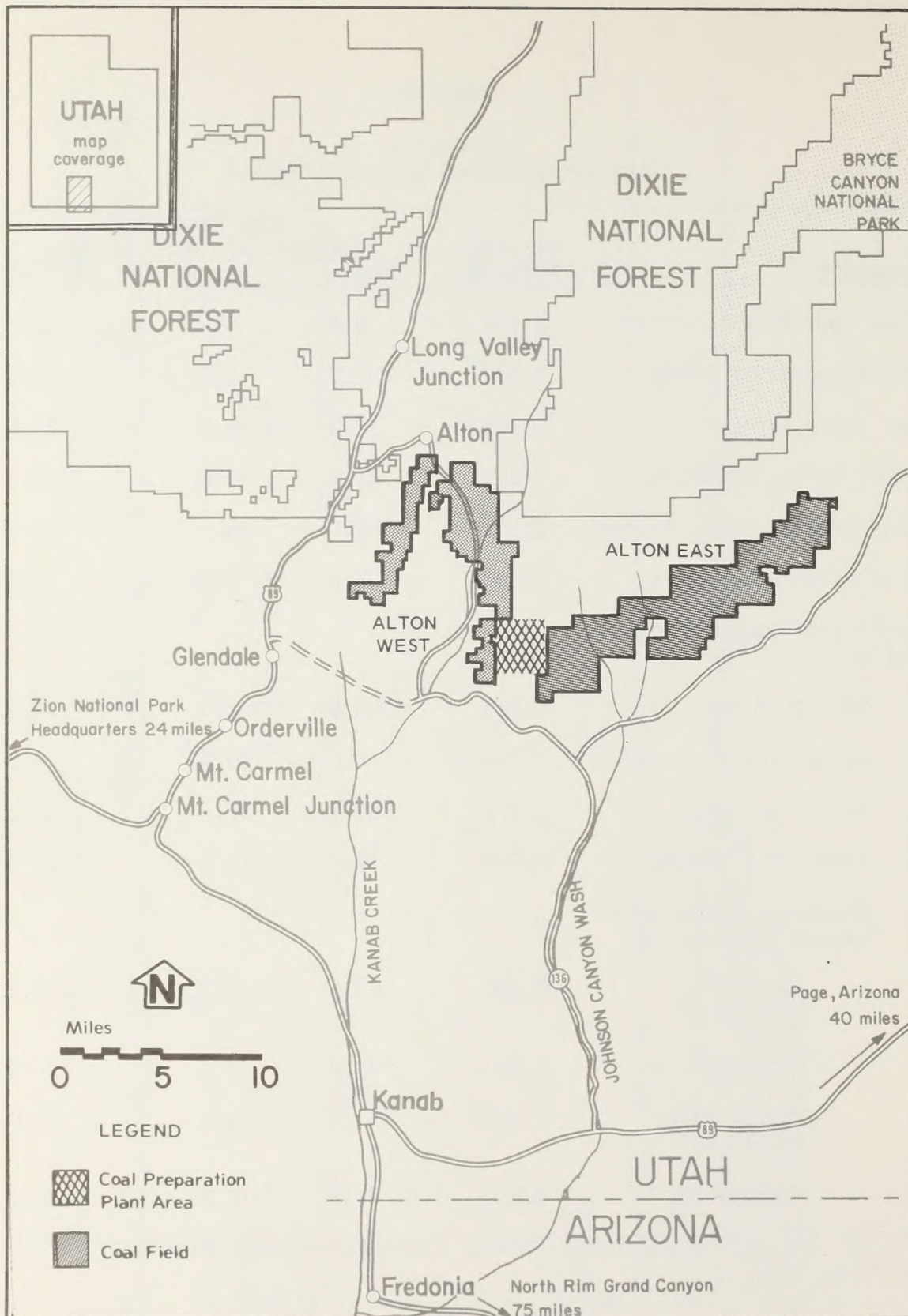


FIGURE 2-2

REGIONAL LOCATION - PROPOSED COAL PREPARATION
PLANT AND ALTON COAL LEASE AREA

Although a mining plan has not been submitted, it would be probable that underground mining would start about 7 years after initiation of surface mining and would run concurrently with the surface mining operation. About 100 million tons of coal would be produced utilizing longwall mining methods. Three entry headings (15 by 20 feet) on 500-foot centers would be driven from the stripping wall to the lease boundary. Entries would be connected by headings that would be required to begin the longwall face. Equipment would consist of continuous miners, shuttle cars, and ancillary equipment. Mining would begin at the center of the property near the coal preparation plant.

Coal Preparation Plant

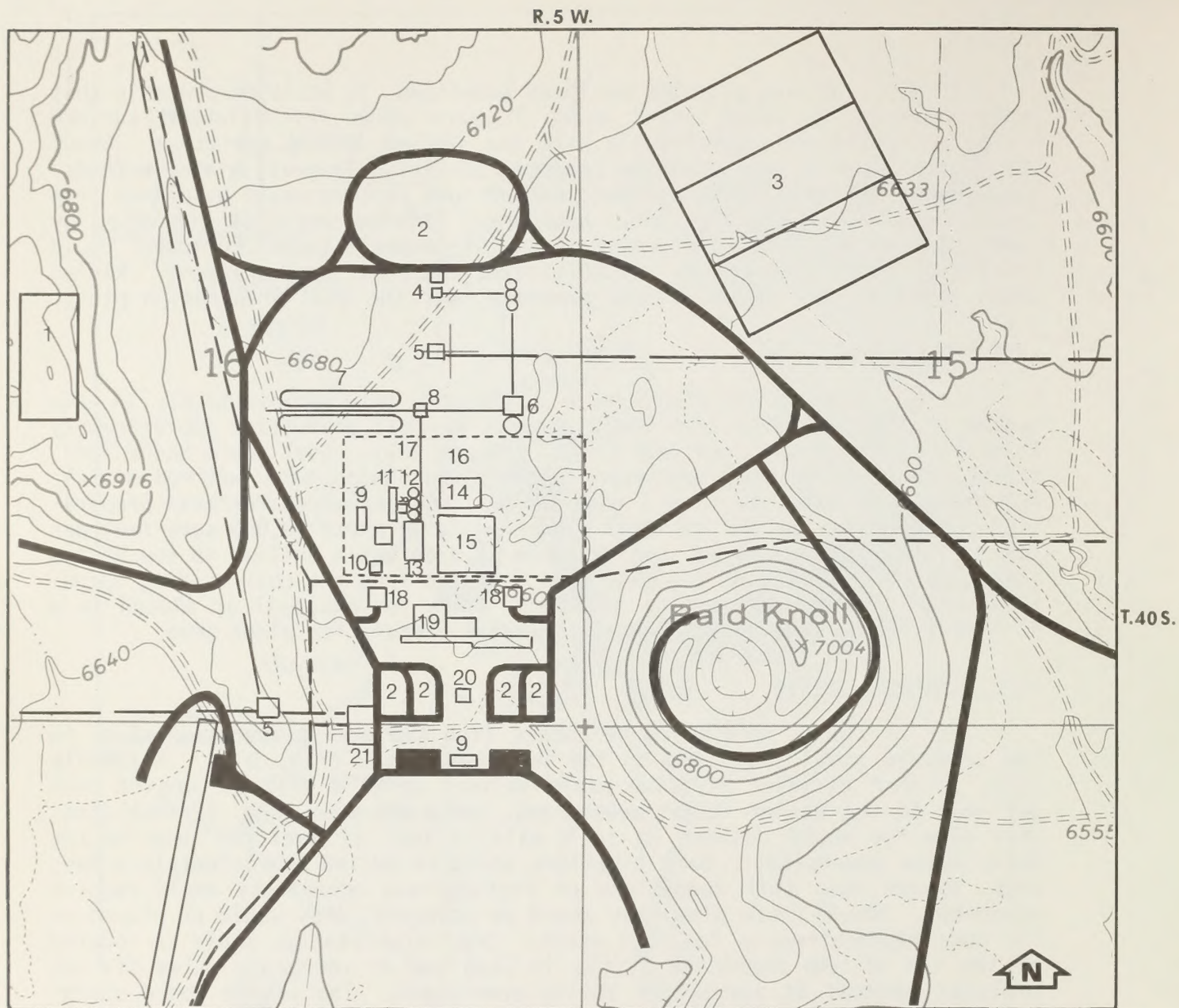
A coal preparation plant on a 1,826-acre site approximately at the center of the coal mine area would produce at full production approximately 11 million tons of coal per year (figs. 2-2 and 2-3). Coal would be crushed, stored, cleaned, washed, dewatered, fine-ground (using cage and rod mills), and mixed with water to form a coal slurry. Water needed for coal preparation plant operation and for coal slurry would be about 10,000 acre-feet per year. This water would be supplied from 13 deep wells drilled in the Navajo Sandstone which underlies the mine area. Wastes from the coal washing operation would be trucked back to mined-out areas for disposal or placed in a 62-acre tailings pond located within the coal preparation plant area.

Coal Transport System

Coal in slurry form would be pumped from the coal preparation plant in two separate steel pipelines to the two powerplants (fig. 2-1). A 73-mile long, 12-inch diameter pipeline would deliver up to 2 million tons of coal per year to the Warner Valley powerplant, and a 183-mile long, 22-inch diameter pipeline would deliver up to 9 million tons of coal per year to the Harry Allen powerplant. Both pipelines would be buried approximately 3 feet deep, except when soil conditions or right-of-way agreements would require otherwise. Where these pipelines would be adjacent, they would be placed in the same right-of-way a few feet apart. One valve station would be located at the top of the Hurricane Cliffs in Utah and an emergency valve station would be located at the Warner Valley powerplant. The slurry would essentially flow by gravity after being pumped into the pipelines at the preparation plant. Construction of the pipelines would involve a total of 2,218 acres.

Warner Valley Powerplant

The proposed powerplant would be located in Washington County, Utah, about 13 miles southeast of St. George (figs. 2-4 and 2-5). The coal-fired steam-electric powerplant would include two generating units with 500-foot high smokestacks. Each steam-turbine unit would be designed to have an estimated net generating capacity of approximately 250 MW. The total net electrical production of the proposed plant would be approximately 500 MW. The primary fuel for these units would be dewatered, pulverized coal, which would be consumed at a maximum rate of 8,090 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Water for the proposed plant would be provided by the proposed Warner Valley water project and the reclaimed water from the coal dewatering facilities within the plant site. The entire plant site would be fenced.



0 1/2 1 Mile

Scale

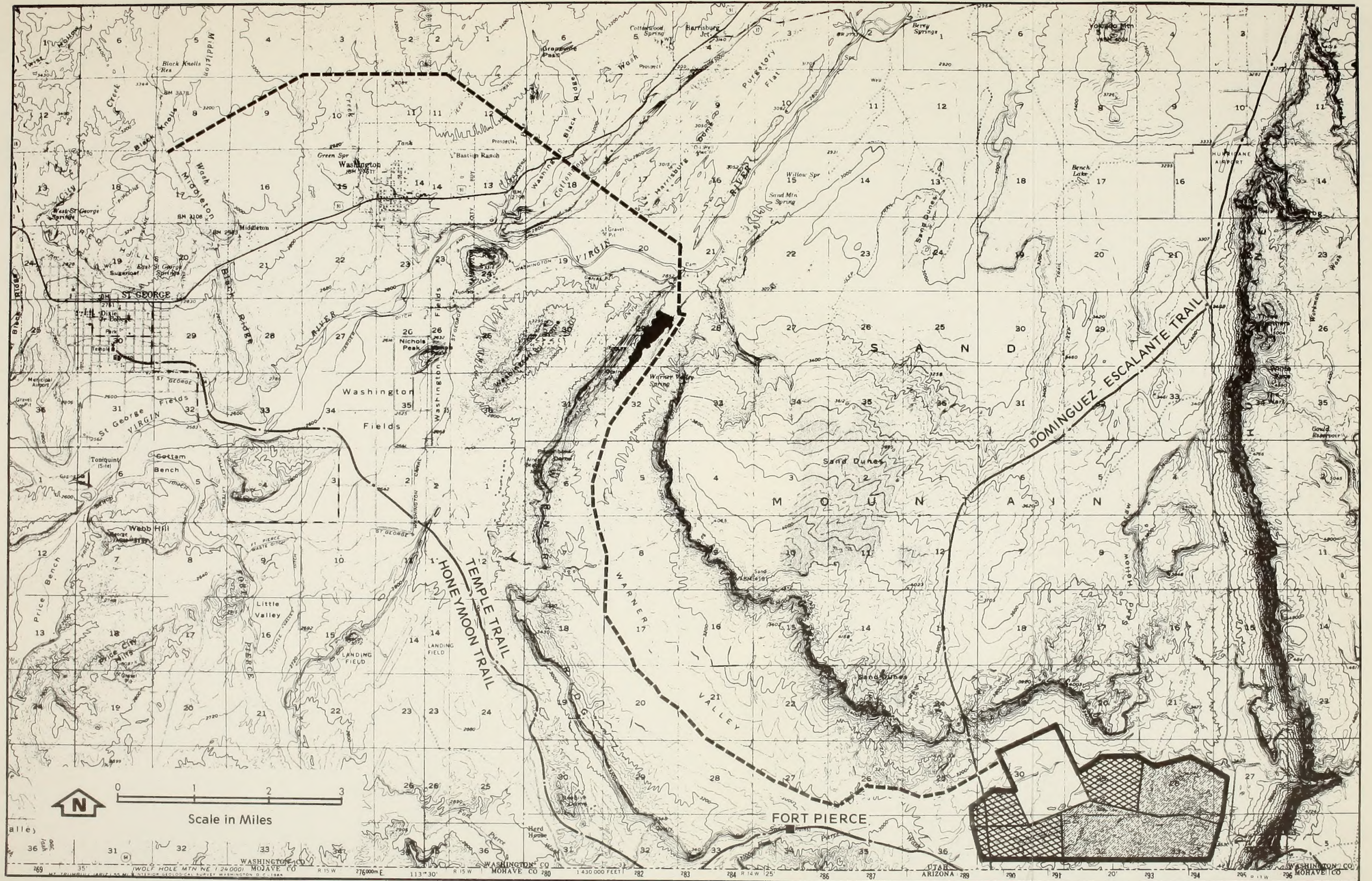
NOTE: Contour Interval 200 Feet

LEGEND

— Access Roads	6 Mill Building	14 Equipment Storage
- - - Water Supply Lines	7 Clean Coal Stockpiles	15 Coal Storage
— Pump Power Lines	8 Sample Building	16 Expansion Area
1 Reservoir Alternative	9 Administration Building	17 Conveyor
2 Emergency Stockpile	10 Substation	18 Dead Line
3 Tailings Ponds	11 Pumpstation	19 Shops And Warehouse
4 Hopper	12 Coal Slurry Tanks	20 Change House
5 Substation	13 Preparation Building	21 Well Site

FIGURE 2-3

LAYOUT OF ALTON COAL PREPARATION PLANT



LEGEND

-  Liquid Waste Disposal Areas
-  Solid Waste Disposal Areas
-  Principal Station Facilities Area
-  Warner Valley Water Project
-  Warner to St. George Electrical Transmission Route

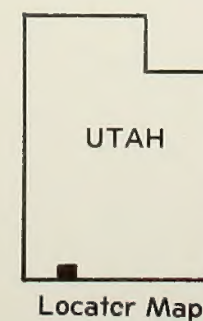


FIGURE 2-4

LOCATION OF WARNER VALLEY
POWERPLANT SITE WITH WASTE
DISPOSAL AREAS, WATER PROJECT,
AND TRANSMISSION ROUTE

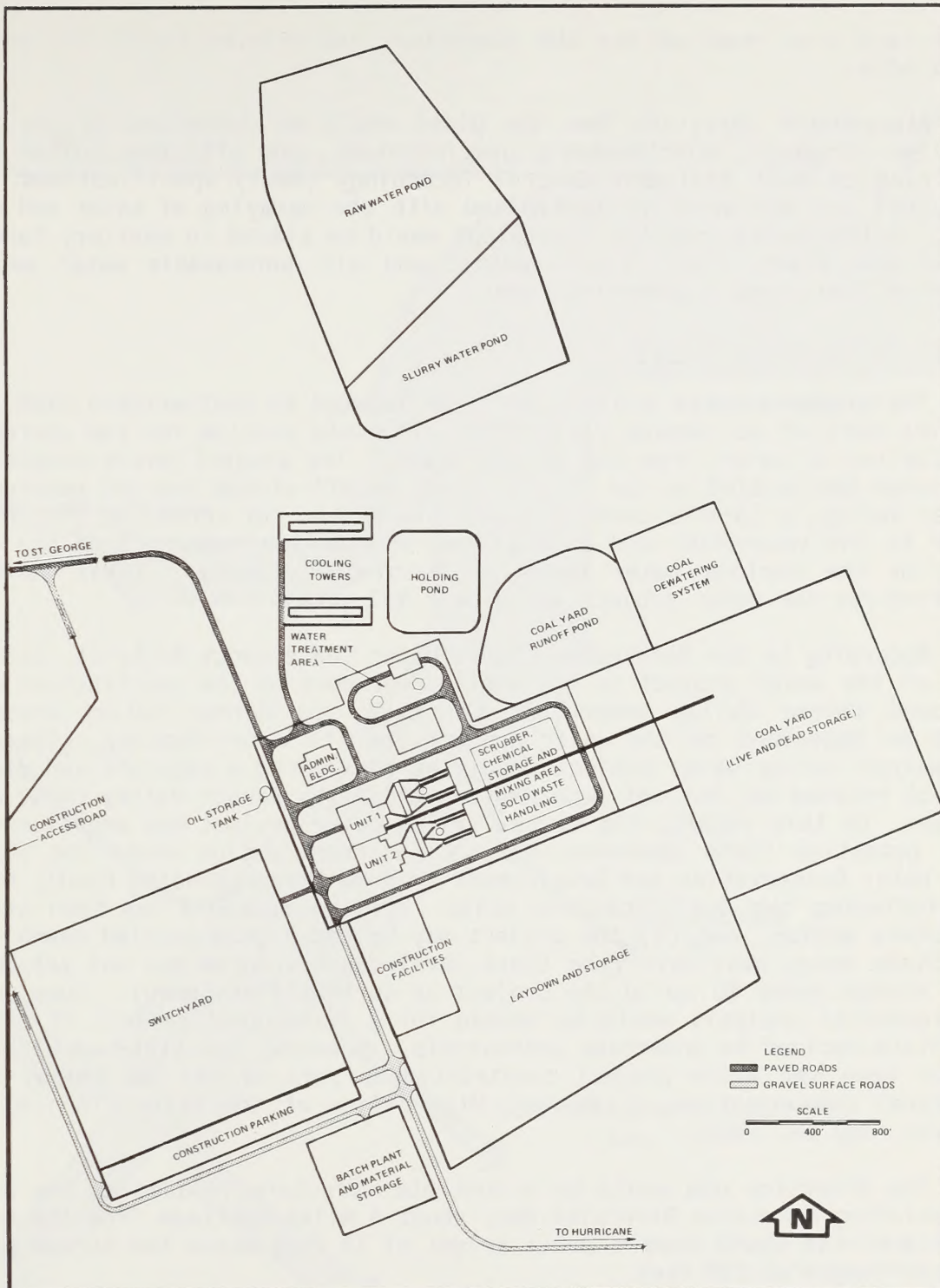


FIGURE 2-5

WARNER VALLEY POWERPLANT FACILITIES

Total land area required for the powerplant and related facilities would be 4,295 acres.

Atmospheric emissions from the plant would be controlled by the use of wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to Best Available Control Technology (BACT) specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals. Solid wastes from the powerplant would be placed in sanitary landfills within the plant site. Liquid wastes and all nonreusable water would be slurried into lined evaporation ponds.

Warner Valley Water Project

The proposed water project would be located in southwestern Utah, about 8 miles east of St. George (fig. 2-4). It would provide for the storage and utilization of water from the Virgin River. The project would consist of a diversion dam located on the Virgin River, an off-stream dam and reservoir in Warner Valley, a 16-mile canal and pipeline system for conveying Virgin River water to the reservoir, and a canal and/or pipeline network from the reservoir to the various water users in Washington County. Total land area required for the water project would be 2,993 acres.

According to the Washington County Water Conservancy District, construction of the water project is not wholly dependent on the construction of the proposed Warner Valley powerplant (although the Warner Valley powerplant would be dependent on the water project for its water supply). Therefore, the Warner Valley water project should be considered a separate and distinct project related to, but not dependent on the Allen-Warner Valley (AWV) energy system. In this regard, the Warner Valley water project has been identified as a potential State sponsored project for construction under the State of Utah Water Conservation and Development Program (Water Bonding Fund); however, the following two qualifications exist: (1) no schedule has been assigned for State action, and (2) the project may be redesigned (scaled down) to fit the State money available (the State development program has not yet identified enough money to build the project as currently designed). Supplemental environmental analysis would be needed for a redesigned project if and when the State decided to undertake sponsorship. However, the State of Utah would rather have the water project constructed as part of the AWV energy system (personal communication, J. Butler, Utah office of the State Planning Coordinator, May 15, 1980).

The diversion dam would be a concrete structure located at the site of the existing Hurricane Diversion dam, about 3 miles upstream from the town of Hurricane. It would have a crest height of 19 feet above the stream bed and a crest length of 118 feet.

Up to 160 cubic feet per second (ft^3/s) would be diverted when the Virgin River flow exceeds the following at the Hurricane gaging station: 40 ft^3/s from October to February, 90 ft^3/s from March to June, and 80 ft^3/s from July through September. The total water to be withdrawn would be about 56,100 acre-feet per year (fig. 2-6). This water would be transported about 16 miles via ditches and pipelines to the site of the Warner Valley reservoir or to the fields in the Hurricane-LaVerkin area.

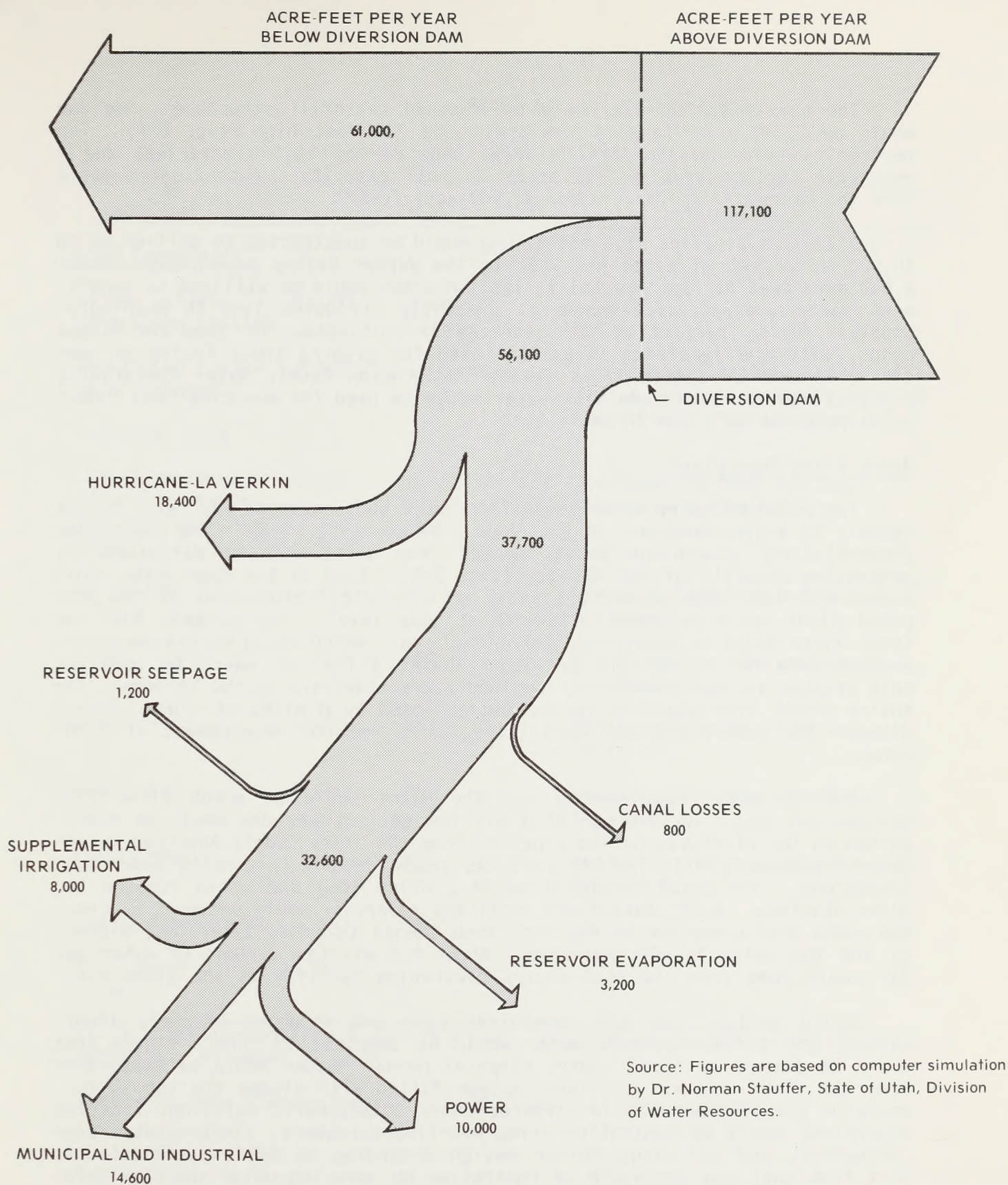


FIGURE 2-6

ALTERNATIVE 1
PROJECTED WATER DIVERSIONS FROM VIRGIN RIVER
(Acre-Feet Per Year)

The Warner Valley dam would be a zoned earthfill structure. The dam would be 3,340 feet long at the crest and 226 feet high (fig. 2-7). The reservoir would have a total storage capacity of 55,000 acre-feet and a reservoir surface area of 750 acres at full capacity. Annual water yield from the reservoir would be about 32,600 acre-feet.

A 24-inch pipeline 11.2 miles long would be constructed to deliver up to 10,000 acre-feet of water per year to the Warner Valley powerplant. About 8,000 acre-feet of supplemental irrigation water would be utilized to supplement water use on 8,930 acres of presently irrigated land in Washington County. Ninety percent of this acreage is cultivated for feed and forage crops, with the remaining 10 percent used for growing truck fruits or specialty crops, or remaining as fallow (Washington County Water Conservancy District, 1975). The remaining water would be used for municipal and industrial purposes as shown in table 2-3.

Harry Allen Powerplant

The 2,000-MW Harry Allen powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-8). The coal-fired steam-electric powerplant would include four units with an estimated net generating capacity of 500 MW each (fig. 2-9). Each of the four units would have a 575-foot high smokestack. The net electrical production of the proposed plant would be about 2,000 MW at peak level. The primary fuel for these units would be dewatered, pulverized coal, which would be consumed at a maximum rate of 31,248 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. The entire plant site would be fenced and enclosed by 6 miles of flood control dikes. The powerplant and facilities would require development of 5,887 acres.

Average water requirements for the plant would be about 31 million gallons per day. An average 24.5 million gallons per day would be transported to the plant via buried pipeline from the Clark County Advanced Wastewater Treatment (AWT) plant in East Las Vegas, Nevada (presently under construction). The pipeline would be 24.5 miles long and would require two valve stations. Each station and ancillary reservoir would occupy 2.5 acres. The route would require an 850-foot long tunnel to cross Interstate Highway 15 and the Union Pacific Railroad. About 5.8 million gallons of water per day would come from the coal slurry dewatering facility at the plant site.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry that would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions from the powerplant would be controlled using wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled by spraying water and chemicals.

Electrical Transmission System

The proposed transmission system would consist of a network of overhead, high voltage, alternating current (AC) electrical transmission lines that

TABLE 2-3

Proposed Distribution of Water Uses

Applicant	Acre-Feet Per Year	Water Use	Comments
<u>Firm Commitment</u>			
Warner Valley Generating Station	10,000	Power Generation	.....
Washington Fields Canal Company	8,000	Irrigation	Supplemental irrigation water for approximately 8,930 acres of presently irrigated lands.
<u>Potential Uses</u>			
Utah Department of Natural Resources, Division of State Lands	6,000	Municipal and Industrial (M&I)	Developments have not been specified by the State.
St. George City	15,000	M&I	Would require complete water treatment.
Ivins	800	M&I	Would require complete water treatment.
Santa Clara	1,000	M&I	Would require complete water treatment.
Washington	3,000	M&I	Would require complete water treatment.
Bloomington	600	M&I	Would require complete water treatment.
Powerplant Reserve	<u>5,000</u>	M&I	.....
Total Reservoir Yield	^a 49,400		

Source: Memorandum from Rudger McArthur, Director of St. George Utilities Commission, December 6, 1979.

^aAssumes a dead storage volume of 5,000 acre-feet in reservoir.

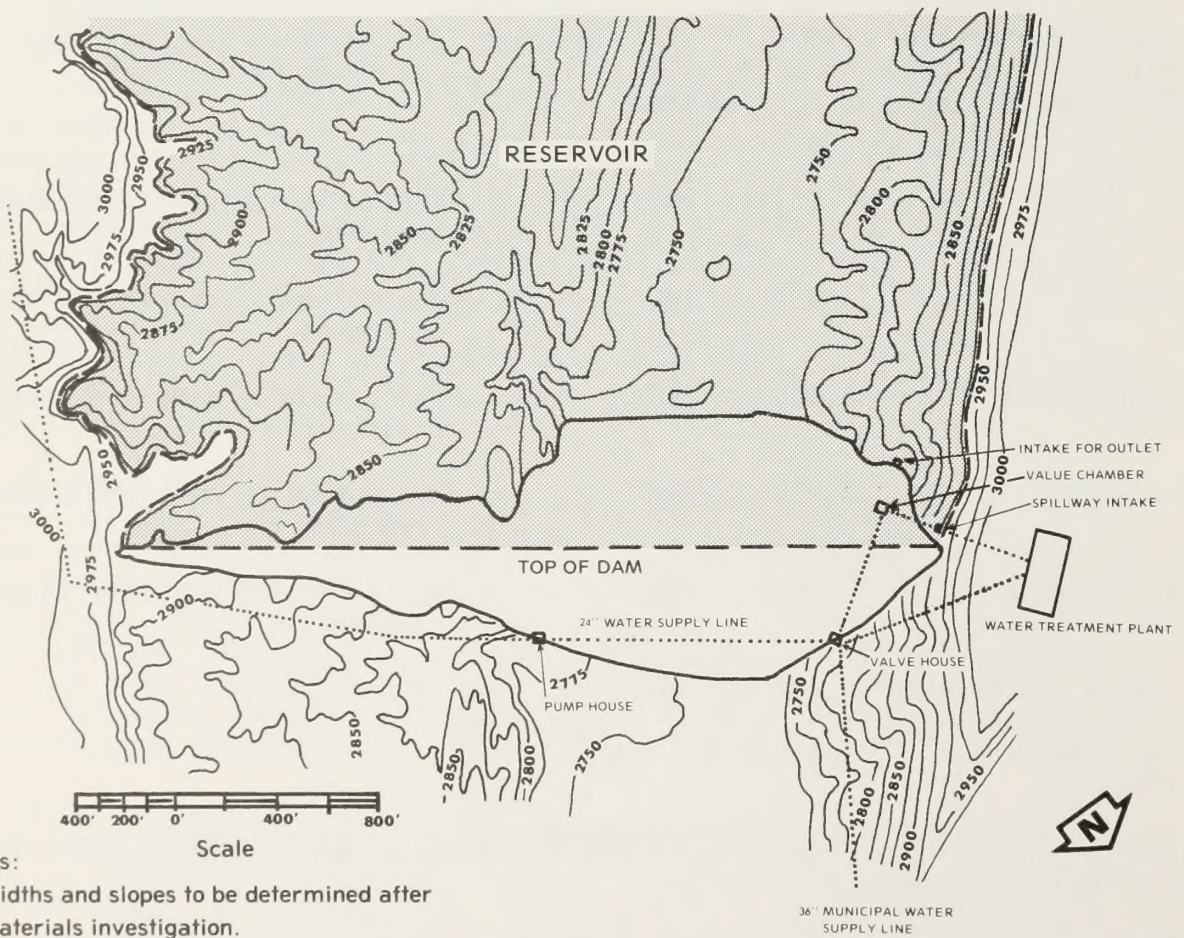
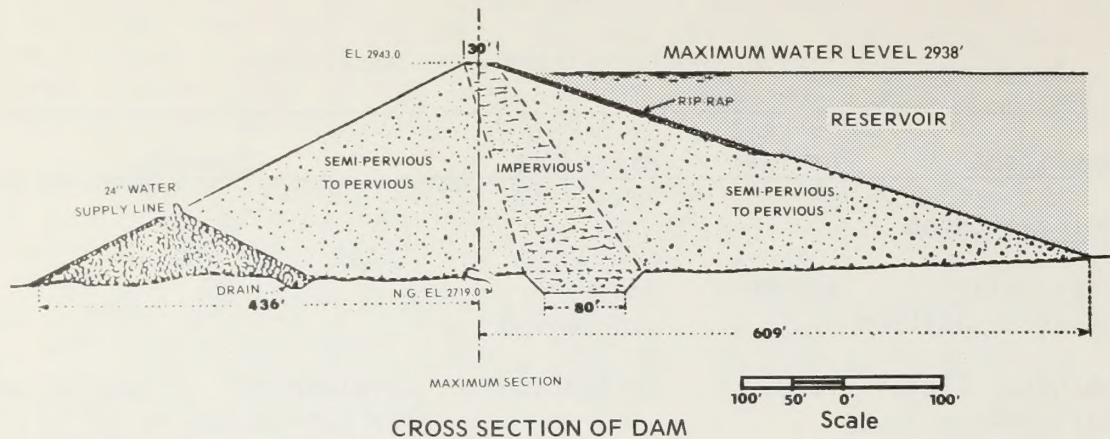


FIGURE 2-7
PROPOSED WARNER VALLEY DAM

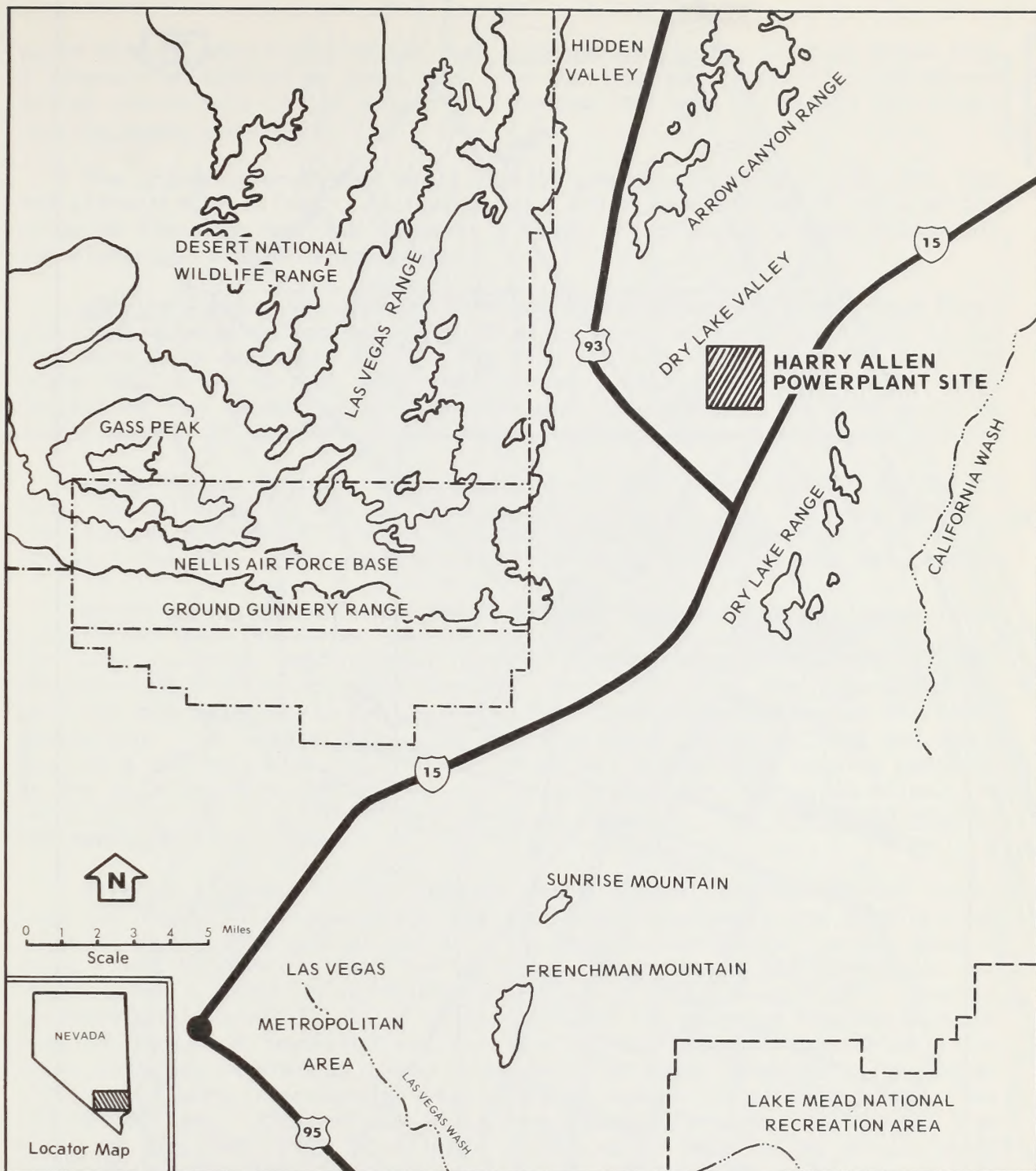


FIGURE 2-8

LOCATION OF HARRY ALLEN POWERPLANT SITE

would deliver electricity to the coal mine and processing plant at Alton from a proposed substation at Spry, and from the proposed Harry Allen and Warner Valley powerplants to the city of St. George, NPC, and California utilities' service areas (fig. 2-1).

The transmission system would involve the construction of 138, 345, and 500-kilovolt (kV) lines. Following is a brief description of each of the proposed transmission line segments. Table 2-4 provides a data summary of the electrical transmission system.

Spry to Alton. This 138-kV line would transmit power from a Utah Power and Light substation approximately 19 miles north of Panguitch, Utah to the coal mine area near Bald Knoll. The line would be about 84 miles long and would require an 80-foot wide right-of-way. Transmission structures would consist of two wooden poles with crossarms and braces. The line would be approximately 70 feet above the ground (Garkane Power Association, 1979).

Warner to St. George. Electricity from the Warner Valley powerplant would be delivered to the St. George substation by this 138-kV powerline. The line would be about 20 miles long and would require a 25-foot wide right-of-way. The line would utilize single 75 to 90-foot high pole structures.

Warner to Pecos. This double circuit, 345-kV transmission line would be constructed from the Warner powerplant to the Utah-Arizona border and would then run parallel and adjacent to the existing 500-kV Navajo-McCullough transmission line to Dry Lake, Nevada. From this point the line would run parallel and adjacent to the existing Reid Gardner-Pecos line to the Pecos substation. The transmission line would be about 120 miles long and would require a 200-foot wide right-of-way (9 miles) except when running parallel to the existing Navajo-McCullough and Reid Gardner corridors (111 miles), in which case a 130-foot right-of-way would be required. The line would utilize 120-foot high steel towers.

Allen to Eldorado. This segment would consist of two 500-kV lines. From the Harry Allen powerplant the proposed lines would run parallel and adjacent to the west side of the existing Reid Gardner-Pecos line for about 5 miles. The lines would then run southeast, cross Interstate Highway 15, and after about 5 miles would rejoin the Navajo-McCullough corridor. Running parallel and adjacent to the existing corridor, the proposed line would cross U.S. 95 south of Henderson and continue to the Eldorado substation. The total distance covered by these lines would be about 48 miles. The 500-kV lines would have free-standing steel lattice towers, ranging in height from 108 to 150 feet. Right-of-way width requirements for the first 500-kV line would be 200 feet (for 11 miles), except where paralleling the existing Navajo-McCullough corridor where a 130-foot right-of-way would be required (for 37 miles). The second 500-kV line would require a 130-foot right-of-way throughout its length (48 miles).

Eldorado to Lugo (Western Transmission System). The Western Transmission System would transmit electricity via two 500-kV transmission lines from the Eldorado substation in southern Nevada to the California system tie-in point 6 miles west of the Lugo substation in southern California. Four alternative routes were studied by the project applicants, the results of which were published in Allen-Warner Valley Energy System: Proponents'

TABLE 2-4

Alternative 1 Data Summary: Electrical Transmission System

Datum	Spry to Alton	Warner to St. George	Warner to Pecos	Allen to Eldorado	Western Transmission System Alternatives			
					Inter-state	Eldorado - Lugo	Victor - McCullough	High-way 66
Right-of-Way Length (miles)	84	20	120	48	175	185	179	238
Transmission Line Length (circuit miles)	84	20	120	96	350	370	358	476
Nominal Right-of-Way Width (feet)	80	25	136	275	330	330	330	330
Total Right-of-Way (acres)	815	46	1,975	1,598	7,000	7,400	7,160	9,520
New Access and Spur Roads Required (miles)	27	20	48	13	117	260	215	327
Permanently Occupied Area ^a (acres)	81	34	83	23	202	445	368	560

Source: NPC, 1975; SCE and PG&E, 1979

^aIncludes those areas to be occupied by new access and spur roads, tower footings, and microwave communication sites.

Environmental Assessment (Southern California Edison Company [SCE] and Pacific Gas and Electric Company [PG&E], 1979). These routes were also studied as alternatives in the preparation of Intermountain Power Project Final Environmental Impact Statement (IPP) (USDI, BLM, 1979). The two 500-kV lines could be routed down a single alternative corridor or the lines could be separated, each occupying one of the alternative corridors. See figure 2-1 for routing and table 2-4 for a summary of the transmission components of each of the alternatives. A description of each of the alternatives follows.

Interstate Highway (I-15). This alternative route would run adjacent to SCE's existing 138-kV line from the Eldorado substation to the Lugo substation in California (except for a detour around Cave Mountain) and would essentially parallel I-15 and a proposed IPP 500-kV line. From Yermo, California up to Victorville the corridor would parallel, at a 2,000-foot separation, an existing Los Angeles Department of Water and Power transmission line and the IPP line. It would then cross over existing (as well as proposed) lines and continue through Victorville in a southwesterly direction until reaching the tie-in point 6 miles west of the Lugo substation.

The BLM Riverside District, in conjunction with the California Public Utilities Commission, San Bernardino County, and the applicants, is studying the feasibility of accommodating both the proposed AWV lines and one of the IPP lines within this same alternative route.

Eldorado-Lugo. This alternative route would essentially run parallel to the northwest of SCE's existing transmission corridor (which includes two 220-kV lines and one 500-kV line) with one line adjacent to the existing lines and the other separated by 2,000 feet. The route would exit the Eldorado substation in a southwesterly course, crossing into California at Nipton. The route would bypass the Cima substation and cross the Old Dad Mountains, Devil's Playground, and run northwest of Twentynine Palms Marine Corps Base. It would then continue in a westerly direction until intersecting the I-15 alternative route to the east of Victorville. The route would be the same as the I-15 route from the point of intersection to the Lugo tie-in point.

Victorville-McCullough. This alternative would be the same as the I-15 route from the Eldorado substation to where it would intersect I-15 on the Nevada-California border. The Victorville-McCullough route would then separate from the I-15 route and run parallel at a separation of 2,000 feet to the south of three existing AC lines (Los Angeles Department of Water and Power) and a 500-kV direct current line (IPP). The route would cross the Clark Mountains, Silver Dry Lake, run south of the Irwin Military Reservation, and continue on a southwesterly course until it intersected the I-15 alternative route at Yermo. The route would be the same as the I-15 alternative from Yermo to the Lugo tie-in point.

Highway 66. This alternative would be the same as the Eldorado-Lugo route from the Eldorado substation to where it would separate 10 miles to the south and parallel adjacent and to the west of an existing Metropolitan Water Department 230-kV line until reaching Homer Mountain. At this point the route would turn southwest. From Goffs, California the route would parallel the Atchison, Topeka, and Santa Fe Railroad until it would cross Highway 66. From this point it would run parallel to the south of Highway 66

until again intersecting the Eldorado-Lugo alternative route near Pisgah Crater. This route would be the same as the Eldorado-Lugo alternative from the point of intersection to the Lugo tie-in point.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. Four air strips (one each) would be needed at the Harry Allen and Warner Valley powerplants, the Alton coal preparation plant, and the Hurricane Cliffs valve station. Eleven microwave stations would be needed to facilitate communication between the various project components. Proposed stations would include 0.25-acre, high-elevation sites at the Alton coal preparation plant, Elkhart Cliffs, the slurryline valve station at the Hurricane Cliffs, Hurricane Cliffs communication station, and the Warner Valley powerplant in Utah; the Harry Allen powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada; Cottonwood Spring in Arizona; and Clipper Mountain in California.

Applicants' Proposed Design and Operating Procedures

The applicants would incorporate the design and operating procedures as listed in Appendix 4 in the event of the construction and operation of their proposed AWV energy system. The design and operating procedures listed would not apply to the proposed coal development.

ALTERNATIVE 2

This alternative would be identical to Alternative 1 without the Warner Valley powerplant and water project. It would consist only of the 2,000-MW coal-fired steam-electric generating system. The system would contain a coal mine, a coal processing facility, a coal slurry pipeline, a coal-fired powerplant, and an electrical transmission system. Project life would be 40 years. Figure 2-10 (located at the back of this volume) indicates the location of the various components of the system. Table 2-5 provides a summary of the requirements of land, water, fuel, manpower, etc. for the various components of this alternative. The distribution of ownership of lands proposed for development is shown in table 2-6. For analysis purposes under this alternative, it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from the participants of the Intermountain Power Project. Following is a brief description of the major components of this alternative.

Coal Mine

A new coal mine would be opened in the Alton coal lease area (about 25 miles north of Kanab, Utah) to provide coal for this alternative (fig. 2-2). Federal and State coal leases and private lands would be developed to produce about 245 million tons of coal over a 40-year period. Coal would be produced by both surface and underground mining methods. The average heat value of the Alton coal (as mined) would be 9,647 Btu/lb. Average quality (as fired) of Alton coal would be 8,897 Btu/lb, 0.86 percent by weight of sulfur, and 7.19 percent by weight of ash (NPC, 1975). The proposed surface mine would

TABLE 2-5
Alternative 2 - Resource Requirements (Daily Averages)

Project Components	Land ^a (acres)	Water (acre-feet)	Coal ^b (tons)	Input				Output				Wastes				
				Electricity (MW)	Oil (barrels)	Lime (tons)	Manpower (worker days)	Water (acre-foot)	Coal ^b (tons)	Electricity (MW)	Solids (tons)	Liquids (acre-foot)	Emissions ^c (tons)			
													SO ₂	TSP	NO _x	
ALTON COAL MINE																
Construction	.....	.....	.....	.....	.....	...	85	.....	d.....	.....	.....	.....	.....	.....	.....	.....
Operation	8,328	0.65	.....	.....	.....	...	842	.....	25,683	.....	.....	.....	.....	.....	.....	.....
CCAL PREPARATION PLANT																
Construction	.....	.....	.....	.....	.....	...	281	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	1,826	21.3	25,683	20.4	.....	...	40	18.23	22,869	.....	.....	2,814	.....	.....	.....	.....
HARRY ALLEN POWERPLANT																
Construction	.....	0.35	.....	.....	.....	...	2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	5,887	64.97	22,869	.....	260	302	300	.....	.....	1,400	.....	3,398	0.57	40.8	8.16	136.22
COAL SLURRY PIPELINE																
Construction	2,218	.....	.....	.....	.....	...	241	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	1,000	18.23	22,869	0.7	.....	...	48	18.23	22,869	.....	.....	.....	.....	.....	.....	.....
ELECTRICAL TRANSMISSION SYSTEM																
Construction	9,665	.....	.....	.....	.....	...	160	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	310	.....	.....	.....	.....	...	8	.....	.....	.....	.....	.....	.....	.....	.....	.....

Source: Compiled from information submitted by NPC, 1975 to 1980

^a Acreage computed on a 40-year project life.

^b Tonnage of all coal computed as having a moisture content of 25.23 percent.

^c Emissions tonnage includes sulfur dioxide (SO₂), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices with powerplant at full operation.

^d Daily average coal production computed from an average operation of 80 hours per week.

^e Powerplant operation computed at 70-percent capacity.

NOTE: MW = megawatts

TABLE 2-6

Alternative 2
Land Ownership of Acreage Affected

Component	Affected Acreage	Land Ownership (Percent of Total Acreage)		
		Public	State	Private
Alton Coal Mine	8,328	78.0	3.4	18.6
Coal Preparation Plant	1,826	32.0	0.0	68.0
Coal Slurryline	2,218	77.0	11.0	12.0
Harry Allen Powerplant	5,887	98.6	0.0	1.4
Electrical Transmission System				
Spry to Alton	815	38.5	7.5	54.0
Allen to Pecos	252	100.0	0.0	0.0
Allen to Eldorado	1,598	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	7,000	68.0	2.0	30.0
Eldorado-Lugo	7,400	73.0	0.0	27.0
Victorville- McCullough	7,160	73.0	0.0	27.0
Highway 66	9,520	73.5	0.2	26.3

Source: NPC, 1975; SCE and PG&E, 1979

yield about 212 million tons of coal. Further discussion is provided under the same component in Alternative 1. Underground mining would start about 7 years after surface mining and would run concurrently with the surface mining operation. About 33 million tons of coal would be produced by underground mining methods. The mine would occupy approximately 8,328 acres (including underground mining areas). Approximately 300 to 400 acres would be disturbed annually as mining would proceed.

Coal Preparation Plant

A coal preparation plant on a 1,826-acre site approximately in the center of the coal mine area would be used to produce at full production approximately 9 million tons of coal per year (fig. 2-2). Coal would be mixed with water to form a coal slurry. Water needs of the coal processing facility would be about 8,000 acre-feet per year, supplied from 10 of the 13 deep wells (Alternative 1) drilled in the Navajo Sandstone. Coarse wastes from the coal washing operation would be trucked back to mined-out areas for disposal, and fine wastes would be placed in a 50-acre tailings pond located within the coal preparation plant area (fig. 2-3).

Coal Transport System

Coal in slurry form would be pumped from the coal preparation plant to the Allen plant site in Dry Lake, Nevada (fig. 2-10). The 22-inch, 183-mile long pipeline would deliver up to 9 million tons of coal per year to the Harry Allen powerplant. The pipeline would be buried approximately 3 feet deep except when soil conditions or right-of-way agreements would require otherwise. One valve station would be located at the Hurricane Cliffs in Utah. The slurry would essentially flow by gravity after being pumped into the pipeline at the Alton coal preparation plant. Construction of the coal transport system would involve a total of 2,218 acres.

Harry Allen Powerplant

Powerplant design would be identical to the same component in Alternative 1. The 2,000-MW powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-8). The coal-fired steam-electric powerplant would include four units with estimated net generating capacity of 500 MW each, and each with a 575-foot high smokestack (fig. 2-9). The net electrical production of the proposed plant would be about 2,000 MW at peak level. The primary fuel for these units would be dewatered, pulverized coal, which would be consumed at a maximum rate of 31,248 tons per day. Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. The powerplant and facilities would require the development of 5,887 acres.

Average water requirements for the plant operating at maximum load would be about 31 million gallons per day. About 24.5 million gallons per day would be transported 24.5 miles to the plant via buried pipeline from the Clark County AWT plant. About 5.8 million gallons per day would come from the coal slurry dewatering facility within the plant site.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry and

would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions would be controlled using wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals.

Electrical Transmission System

The proposed transmission system would consist of a network of overhead, high voltage, AC electrical transmission lines that would deliver electricity to the coal mine, and from the proposed Harry Allen powerplant to the NPC and California utilities service areas. The transmission system would involve 138, 230, and 500-kV lines (fig. 2-10). Following is a brief description of each of the proposed transmission lines. Table 2-7 provides a data summary of the electrical transmission system.

Spry to Alton. This 138-kV line would transmit electricity from a Utah Power and Light substation approximately 19 miles north of Panguitch, Utah to the coal mine area near Bald Knoll. The line would be about 84 miles long and would require an 80-foot wide right-of-way. Transmission structures would consist of two wooden poles with crossarms and braces. The line would be approximately 70 feet above the ground.

Allen to Pecos. This system would consist of two 345-kV lines on single towers to be constructed between the proposed Harry Allen powerplant and the Pecos substation (about 8 miles north of Las Vegas). This double-circuit line would run parallel and adjacent to the west side of the existing 230-kV Reid Gardner-Pecos corridor for most of its length. For the first 5 miles it would also parallel the proposed Allen to Eldorado lines. The total distance covered by each line would be about 16 miles. The two lines would require a total right-of-way width of 175 feet. Steel transmission towers 120 feet high would be used.

Allen to Eldorado. This segment would consist of two 500-kV lines. From the Harry Allen powerplant the proposed lines would run parallel and adjacent to the west side of the existing Reid Gardner-Pecos line for about 5 miles. The lines would then turn southeast, cross Interstate 15, and after about 5 miles join the Navajo-McCullough corridor. Running parallel and adjacent to the existing corridor, the proposed line would head in a southerly direction, cross U.S. 95 south of Henderson, and continue to the Eldorado substation. The total distance covered by these lines would be about 48 miles. The 500-kV lines would have free-standing steel lattice towers, ranging in height from 108 to 150 feet. Right-of-way requirements for the first 500-kV line would be 200 feet except when paralleling the existing power corridor, then only 130 feet would be required. The second 500-kV line would require a 130-foot right-of-way throughout its length.

Eldorado to Lugo (Western Transmission System). The two 500-kV lines could be constructed in one of the following four alternative routes or could be separated with one line constructed in each of two of the alternatives: Interstate Highway 15, Eldorado-Lugo, Victorville-McCullough, or Highway 66 (fig. 2-10). The routes and their components are described in Alternative 1 and would be identical for this alternative.

TABLE 2-7

Alternative 2 Data Summary: Electrical Transmission System

Datum	Western Transmission System Alternatives				
	Spry to Alton	Allen to Pecos	Allen to Eldorado	Inter- state 15 Lugo	Victor- ville - McCullough Highway 66
Right-of-Way Length (miles)	84	16	48	175	179
Transmission Line Length (circuit miles)	84	16	96	350	358
Nominal Right-of-Way Width (feet)	80	130	275	330	330
Total Right-of-Way (acres)	815	252	1,598	7,000	7,160
New Access and Spur Roads Required (miles)	27	2	13	117	215
Permanently Occupied Area ^a (acres)	81	4	23	202	368
				445	560

Source: SCE and PG&E, 1979

^aIncludes those areas to be occupied by new access and spur roads, tower footings, and microwave communication sites.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. One air strip would be needed at each of the following locations: the Harry Allen powerplant; the Alton coal preparation plant; and the Hurricane Cliffs valve station. Ten microwave stations would be needed to facilitate communication between the various project components. Proposed stations include 0.25-acre, high-elevation sites at the Alton coal preparation plant, Elkhart Cliffs, the slurryline valve station at the Hurricane Cliffs, and the Hurricane Cliffs communication station in Utah; the Harry Allen powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada; Cottonwood Spring in Arizona; and Clipper Mountain in California.

ALTERNATIVE 3

This alternative would consist of a 250-MW powerplant at the Warner Valley site and a 1,000-MW powerplant at the Harry Allen site. Coal for the Warner powerplant would be trucked from the Alton coal lease area, and coal for the Allen powerplant would be delivered by rail from the southwestern Wyoming or central Utah coal fields. Project life would be 40 years. Figure 2-11 (located at the back of this volume) indicates the location of the various components of the system. Table 2-8 provides a summary of the requirements of land, water, fuel, manpower, etc. for the various components of this alternative. The distribution of ownership of lands proposed for development is shown in table 2-9. Following is a brief description of the major components of this alternative.

Coal Source

Coal for the Warner Valley powerplant would come from a new coal mine within the presently undeveloped Alton coal lease area (about 25 miles north of Kanab, Utah; fig. 2-2). Existing Federal leases would be developed to produce about 1 million tons of washed coal per year from the Alton West lease area, involving the development of 1,830 acres. A small plant at the site would process the coal from the mine.

Coal for the Allen powerplant would be railed from central Utah or southwestern Wyoming (fig. 2-11). Central Utah coal would be mined by underground methods. It would come from increased production of existing coal mines and development of several new mines. Approximately 3 million tons of coal per year would be required. The Development of Coal Resources in Central Utah Final Environmental Statement (CU) (USDI, USGS, 1979) addressed several new mines that had unspecified coal markets. The "high level production scenario" from central Utah, totaling up to 42 million tons per year, would be sufficient to meet the fuel needs of this proposed powerplant. The average coal quality for central Utah would be 12,600 Btu/lb, 0.45 percent by weight of sulfur, and 6.5 percent by weight of ash. Approximately 4,540 acres would be developed for the coal mine.

Southwestern Wyoming coal would be strip mined from several new mines in the Rock Springs area. The production of about 4 million tons of coal per year for this project would be in addition to that of the projected "high

TABLE 2-8

Alternative 3 - Resource Requirements (Daily Averages)

Project Components	Land ^a (acres)	Water (acre-feet)	Input					Output					Wastes			NO _x	
			Coal ^b (tons)	Electricity (MW)	Oil (barrels)	Lime (tons)	Manpower (workers)	Water (acre-foot)	Coal ^b (tons)	Electricity (MW)	Solids (tons)	Liquids (acre-foot)	Emissions (tons)				
													SO ₂	TSP			
ALTON COAL MINE																	
Construction	.....	.....	.....	.....	.....	...	64	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	1,830	0.45	3,184	3.0	.....	...	210	.....	.....	.....	.....	0.01	.....	.....	.....	.....	.....
CENTRAL UTAH COAL OPTION ^e																	
Construction	.....	.....	.....	.....	.....	...	131	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	4,540	0.48	8,074	.....	174.0	...	1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
SOUTHWESTERN WYOMING COAL OPTION ^f																	
Construction	.....	.....	.....	.....	.....	...	150	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	12,670	0.57	.....	.....	310.0	...	320	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
HARRY ALLEN POWERPLANT (1,000 MW) ^g																	
Construction	.....	0.17	.....	.....	.....	...	1,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	5,000	32.48	8,074	.....	130.0	56	225	.....	.....	.....	.....	0.29	.....	7.95	1.22	.....	87.2
Southwestern Wyoming Coal Option																	
Construction	.....	0.17	.....	.....	.....	...	1,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	5,000	32.48	10,352	.....	130.0	86	225	.....	.....	.....	.....	0.29	.....	12.06	1.75	.....	72.66
WARNER VALLEY POWERPLANT (250 MW) ^g																	
Construction	.....	0.04	.....	.....	.....	...	640	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	3,647	7.95	2,834	.....	32.62	78	100	.....	.....	.....	.....	0.7	.....	5.19	1.02	.....	17.15
WARNER VALLEY WATER PROJECT																	
Construction	.....	.....	.....	.....	.....	...	150	.....	65.75	.....	.....	.....	.....	.....	.....	.....	.....
Operation	2,993	127.0	.....	.....	.....	...	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ELECTRICAL TRANSMISSION SYSTEM																	
Construction	7,388	.....	.....	.....	.....	...	200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	359	.....	.....	.....	.....	...	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Source: Interpolated from information submitted by NPC, 1975 to 1980; CU, USOI, USGS, 1979; SW, USOI, BLM, 1978; Washington County Water Conservancy District, 1975

^a Acreage computed on a 40-year project life.

^b Daily average coal production computed from an average operation of 80 hours per week.

^c Emissions tonnage includes sulfur dioxide (SO₂), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices with powerplant operating at full capacity.

^d Tonnage of Alton coal computed with moisture content of 25.23 percent. The coal mine would include a small coal processing plant.

^e Tonnage of Central Utah coal computed with moisture content of 6.1 percent.

^f Tonnage of southwestern Wyoming coal computed with moisture content of 18.26 percent.

^g Powerplant operation computed at 70-percent capacity.

NOTE: MW = megawatts

TABLE 2-9

Alternative 3
Land Ownership of Acreage Affected

Component	Affected Acreage	Land Ownership (Percent of Total Acreage)		
		Public	State	Private
Central Utah Coal Option	4,540.0	85.7	0.0	14.3
Southwestern Wyoming Coal Option	12,670.0	41.2	1.2	57.6
Alton Coal Mine	1,830.0	100.0	0.0	0.0
Warner Valley Powerplant	3,647.0	85.0	15.0	0.5
Warner Valley Water Project	2,993.0	68.0	23.0	9.0
Harry Allen Powerplant	5,000.0	98.6	0.0	1.4
Truck Coal Transportation Route				
Alton to Warner Valley	727.4	78.7	6.3	15.0
Electrical Transmission System				
Spry to Alton	815.0	38.5	7.5	54.0
Warner to St. George	46.0	70.0	30.0	0.0
Warner to Pecos	1,121.0	86.7	11.7	1.6
Allen to Eldorado	1,164.0	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	4,242.0	68.0	2.0	30.0
Eldorado-Lugo	4,484.0	73.0	0.0	27.0
Victorville- McCullough	4,340.0	73.0	0.0	27.0
Highway 66	5,770.0	73.5	0.2	26.3

Source: CU, USDI, USGS, 1979; SW, USDI, BLM, 1978; NPC, 1975; SCE and PG&E, 1979

level production scenario" (35.6 million tons per year) and would create a total coal production level in southwestern Wyoming of up to 39 million tons per year (Development of Coal Resources in Southwestern Wyoming Final Environmental Statement [SW], USDI, BLM, 1978). The average coal quality for southwestern Wyoming would be 9,827 Btu/lb, 0.54 percent by weight of sulfur, and 7.38 percent by weight of ash. As many as 12,670 acres would be involved with the development of mines in southwestern Wyoming.

Coal Transport System

Coal would be moved by truck on paved roads to the Warner powerplant from the Alton coal lease area. The haul distance from the coal mine to Warner Valley would be about 75 miles via Johnson Canyon, Glendale Bench, Kanab Canyon, and Hancock Road to Cane Beds, Arizona. From Cane Beds, the route would generally follow the existing Antelope Spring road to the Rock Canyon area, where it would terminate at the Warner Valley powerplant (fig. 2-12). This route would cross two highways (U.S. 89 and Arizona 389) and would bypass Coral Pink Sand Dunes State Park. All existing roads would be upgraded from their existing light to medium status, to a paved, two lane, 24 to 30-foot wide heavy duty roadway. Approximately 15 miles of new road would need to be constructed. The 1 million tons of coal per year required by the Warner Valley powerplant would require moving 154 25-ton truckloads per day (roundtrip 260 days per year) over this route.

Other truck routes were considered for hauling coal to the proposed Warner Valley powerplant and several alternative routes have been suggested by the Kane County Commissioners (letter dated March 26, 1980). Should this alternative be selected for implementation, the route and design would be finalized with cooperation of local and State governments, individuals, the project applicants, and BLM.

Coal would be moved by rail to the Allen powerplant from the central Utah or southwestern Wyoming coal fields (fig. 2-11). If central Utah coal would be used, it would be trucked from the coal mines to nearby railroad car loading facilities, then railed to the Allen powerplant. The coal would be shipped on existing Denver and Rio Grande Western lines over Soldier Summit, through Thistle, and into Provo. From Provo the coal would be transported on Union Pacific (UP) lines to Lynndyl, then south on UP's mainline tracks to the Allen powerplant site. Should southwestern Wyoming coal be utilized for this alternative, the coal would be railed over short spur lines to UP mainline trackage, then railed on UP lines through Evanston, Ogden, Salt Lake City, and south to the Allen powerplant site.

The 3 to 4 million tons of coal per year would require 0.8 to 1.1, 10,000-ton unit trains per day. Existing trackage along both proposed routes could accommodate this increase in traffic without any new construction.

Warner Valley Powerplant

The size and design of the powerplant have been formulated for analytical purposes only, and do not reflect engineering studies. The proposed powerplant would be located in Washington County, Utah about 13 miles southeast of St. George (fig. 2-4). The coal-fired steam-electric generating system would have two 125-MW generating units with a net output of 250-MW at

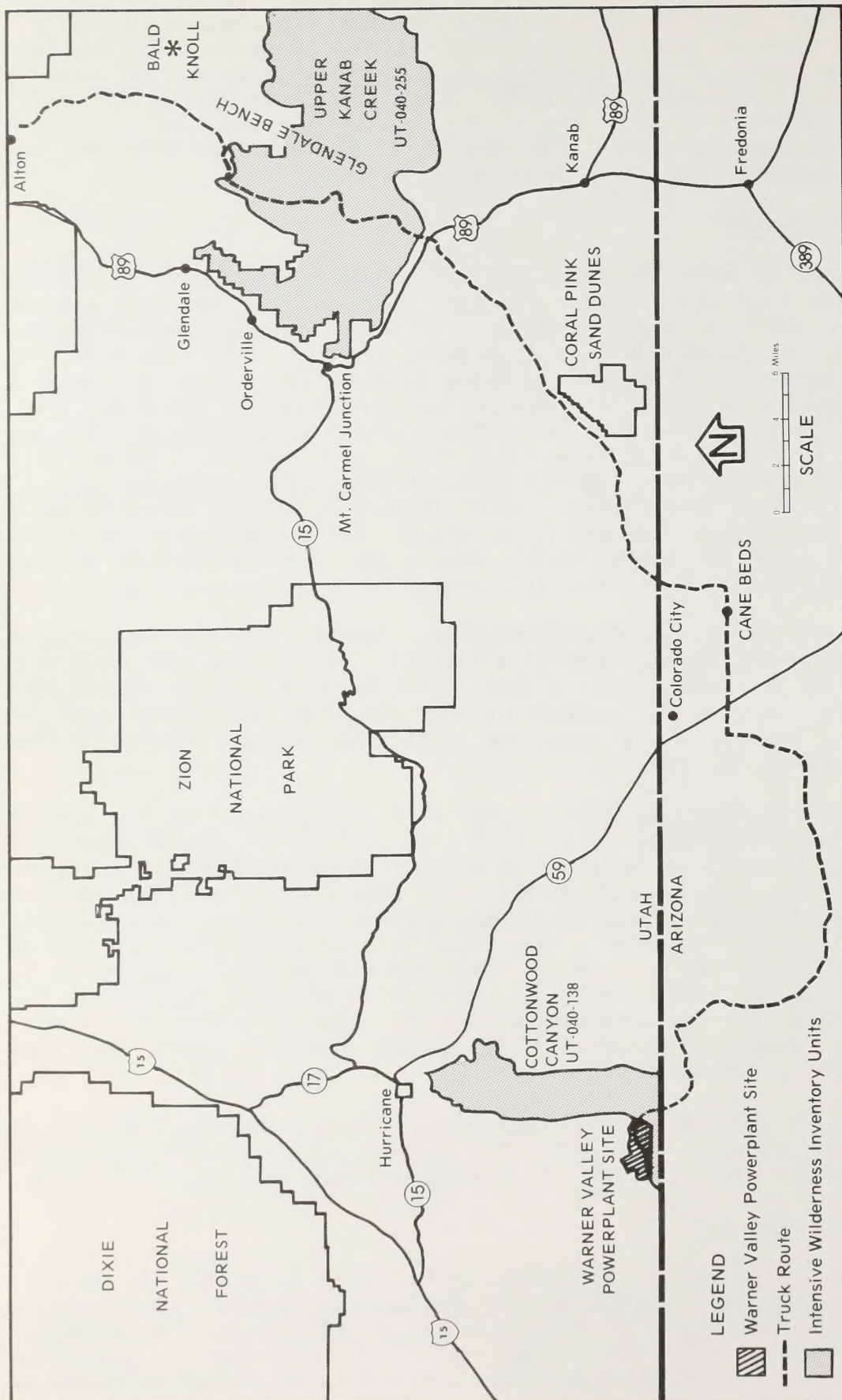


FIGURE 2-12
TRUCK COAL TRANSPORTATION ROUTE
ALTERNATIVE 3

peak level. Each unit would have a 500-foot high smokestack. The primary fuel for this unit would be coal, which would be consumed at a maximum rate of about 4,000 tons per day. Number 2 fuel oil would be used for cold start-up and maintenance of low-load flame stability in the boilers. Water for the proposed plant would be provided by the proposed Warner Valley water project. Approximately 3,647 acres of land would be developed to construct and operate the powerplant.

Solid wastes from the powerplant would be placed in sanitary landfills within the plant site. Liquid wastes and all nonreusable water would be disposed of in lined evaporation ponds. Atmospheric emissions would be controlled by wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled by spraying water and chemicals.

Warner Valley Water Project

The facility would be designed as described under Alternative 1 (fig. 2-4), except the total amount of water diverted from the Virgin River would be 47,600 acre-feet per year instead of 56,100 acre-feet per year, due to a reduced water diversion schedule (fig. 2-13). With this reduced diversion schedule an annual reservoir yield of 24,000 acre-feet would be anticipated. A total of 2,993 acres would be needed to construct the project. Although the water project would be needed as a water supply source for the Warner Valley powerplant, its implementation is not dependent on the powerplant. As shown in table 2-10, the project would be used primarily as a water supply for municipal, industrial, and agricultural uses. Interim uses for recreation and sports fisheries could also be developed. Should the Warner Valley powerplant not be constructed, the 6,000 acre-feet of water per year would be delegated for interim uses until another need (municipal, industrial, agricultural) could be found.

Harry Allen Powerplant

The size and design of the powerplant have been formulated for analytical purposes only, and do not reflect engineering studies. The 1,000-MW powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-8). The powerplant would consist of two 500-MW generating units with accompanying 575-foot high smokestacks (fig. 2-9). The net electrical production of the proposed plant would be 1,000 MW at peak level. The primary fuel would be coal, which would be consumed at a maximum rate of 8,000 to 10,350 tons per day, depending upon the coal source (table 2-8). Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Approximately 5,000 acres would be utilized to construct and operate the powerplant.

Average water requirements for the plant would be about 16 million gallons per day. As described in Alternative 1, the water would be transported to the plant via a 24.5-mile long buried pipeline starting at the Clark County AWT plant in East Las Vegas.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry and would be pumped to lined slurry disposal ponds. Water would be evaporated

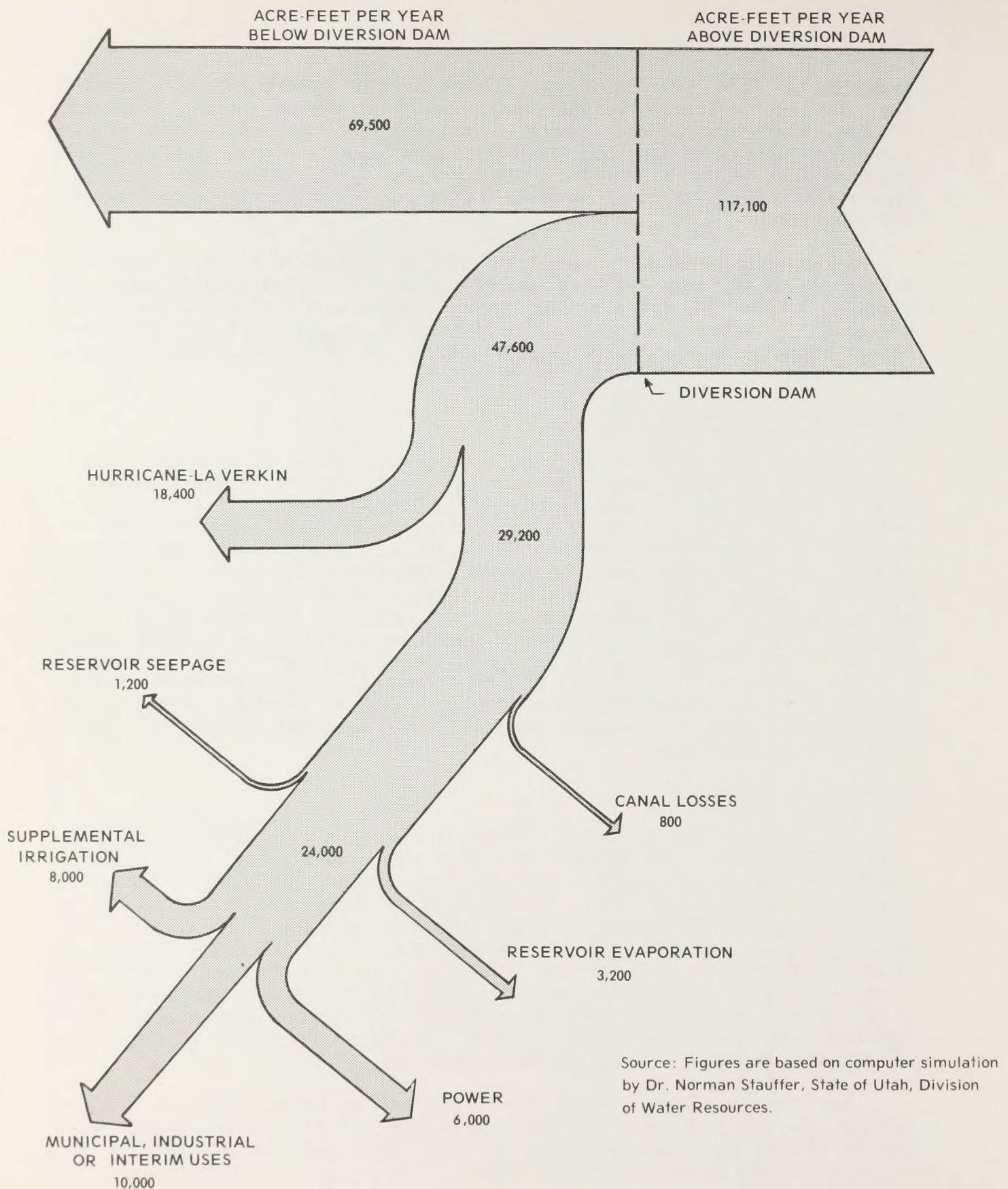


FIGURE 2-13
ALTERNATIVE 3
PROJECTED WATER DIVERSIONS FROM VIRGIN RIVER
(Acre-Feet Per Year)

TABLE 2-10

Projected Distribution of Water Uses

Projected User	Acre-Feet Per Year	Water Use	Comments
<u>Firm Commitment</u>			
Warner Valley Powerplant	6,000	Power Generation	.....
Irrigation Companies	8,000	Irrigation	Supplemental supply for presently irrigated lands.
<u>Potential Use</u>			
Utah Department of Natural Resources, Division of State Lands	2,803	Municipal and Industrial (M&I)	Developments have not been specified by the State.
St. George City	4,674	M&I	Would require complete water treatment.
Ivins	374	M&I	Would require complete water treatment.
Santa Clara	467	M&I	Would require complete water treatment.
Washington	1,402	M&I	Would require complete water treatment.
Bloomington	280	M&I	Would require complete water treatment.
<u>Interim Use^a</u>			
Public	<u>(10,000)</u>	Recreation and Fisheries	Assumes an annual reservoir drawdown of less than ten feet.
Total Reservoir Yield	^b 24,000		.....

Source: Distribution figures were interpolated from the original applicant's proposal project description (Washington County Water Conservancy District, 1975) and the reduced diversion projections necessary to comply with U.S. Fish and Wildlife Service memorandum guidelines for protection of the endangered woundfin minnow (USDI, USFWS, 1978).

^aWater would be allocated for this use until an actual need develops for potential users.

^bAssumes a dead storage volume of 5,000 acre-feet in reservoir.

from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions would be controlled with wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals.

Electrical Transmission System

The proposed electrical transmission system would be basically the same as described under Alternative 1 (fig. 2-11). Where differences exist, they are noted. Table 2-11 provides a data summary of the transmission system.

Spry to Alton. No change.

Warner to St. George. No change.

Warner to Pecos. This 230-kV transmission line would run from the Warner Valley powerplant south to the Utah-Arizona border and would then run parallel and adjacent to the existing 500-kV Navajo-McCullough transmission line as far as Dry Lake, Nevada. From there the line would run parallel and adjacent to the Reid Gardner-Pecos line as far as the Pecos substation. The transmission line would be about 120 miles long and would require a 100-foot right-of-way except when running parallel to the existing Navajo-McCullough corridor, in which case a 75-foot right-of-way would be required. The line would utilize 80 to 110-foot tall steel towers.

Allen to Eldorado. This segment would consist of one 500-kV transmission line. From the Harry Allen powerplant the proposed line would run parallel and adjacent to the west side of the existing Reid Gardner-Pecos line for about 5 miles. The line would then turn southeast, cross Interstate 15, and after about 5 miles would join the Navajo-McCullough corridor. Running parallel and adjacent to the existing power corridor, the proposed line would head in a southerly direction, cross U.S. 95 south of Henderson, and continue to the Eldorado substation. The total distance covered by this line would be about 48 miles. The 500-kV line would have free-standing steel lattice towers, ranging in height from 108 to 150 feet. A 200-foot wide right-of-way would be required.

Eldorado to Lugo (Western Transmission System). The 500-kV line would be constructed in one of the following four alternative routes: Interstate Highway 15, Eldorado-Lugo, Victorville-McCullough, or Highway 66 (fig. 2-11). The routes are described in Alternative 1 and would be identical for this alternative. A summary of data concerning this transmission system is presented in table 2-11.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. Two air strips (one each at the Harry Allen and Warner Valley powerplants), and seven microwave communication stations (one each at the Hurricane Cliffs and Warner Valley powerplant in Utah; the Harry Allen powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada; and Clipper Mountain in California) would be constructed.

TABLE 2-11

Alternative 3 Data Summary: Electrical Transmission System

Datum	Warner				Western Transmission System Alternatives		
	Spry to Alton	Warner to St. George	to Pecos	Allen to Eldorado	Inter-state 15	Eldorado - Lugo	Victor - ville - McCullough 66 Highway
Right-of-Way Length (miles)	84	20	120	48	175	185	238
Transmission Line Length (circuit miles)	84	20	120	48	175	185	238
Nominal Right-of-Way Width (feet)	80	25	77	200	200	200	200
Total Right-of-Way (acres)	815	46	1,121	1,164	4,242	4,484	5,770
New Access and Spur Roads Required (miles)	27	15	43	12	110	254	309
Permanently Occupied Area ^a (acres)	81	34	75	21	148	343	426

Source: NPC, 1975; SCE and PG&E, 1979

^aIncludes those areas to be occupied by access and spur roads, tower footings, and microwave communication sites.

ALTERNATIVE 4

This alternative would utilize coal from the developed coal mining areas of central Utah or southwestern Wyoming. The coal would be shipped by rail to a 2,000-MW powerplant at Dry Lake, Nevada. The system would consist of existing and/or new coal mines, the existing railroad network, the Allen powerplant, and an electrical transmission system. A project life of 40 years is assumed. Figure 2-14 (located at the back of this volume) indicates the location of the various components of the system. Table 2-12 provides a summary of the requirements of land, water, fuel, manpower, etc. for the various components of this alternative. The distribution of ownership of lands proposed for development is shown in table 2-13. For analysis purposes under this alternative, it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from participants of the Intermountain Power Project. Following is a brief description of the major components of this alternative.

Coal Mines

Coal for this alternative would come from the central Utah coal fields in the general vicinity of Price, Utah or from southwestern Wyoming coal fields near Rock Springs, Wyoming (fig. 2-14). Approximately 6 million tons of coal per year would be required if central Utah would be used as the coal source, involving the development of 9,080 acres. Approximately 8.15 million tons per year would be needed if southwestern Wyoming coal would be used, involving the development of 25,340 acres. The production under the "high level production scenario" (addressed in CU, USDI, USGS, 1979) would be sufficient to meet the demand for coal from central Utah. The demand for coal would increase production to nearly 44 million tons per year in southwestern Wyoming, which would be approximately 13 million tons above projected production rates under the "high level production scenario" (SW, USDI, BLM, 1978). Refer to the coal source discussion in Alternative 3 for additional information.

Coal Transport System

The coal transport system would be basically the same as described for the 1,000-MW Allen powerplant in Alternative 3, except 6 to 8 million tons of coal per year would require about 1.6 to 2.2, 10,000-ton unit trains per day. Existing trackage along both proposed routes could accommodate this increase in traffic without any new construction (fig. 2-14).

Harry Allen Powerplant

Facility design would be essentially the same as described in Alternative 1. The 2,000-MW powerplant would be located in Dry Lake, approximately 25 miles northeast of Las Vegas, Nevada (fig. 2-8). The powerplant would consist of four 500-MW generating units with accompanying 575-foot high smokestacks (fig. 2-9). The net electrical production of the proposed plant would be 2,000 MW at peak level. The primary fuel would be coal, consumed at an average rate of 16,150 to 20,705 tons per day, depending on the coal source (table 2-12). Number 2 fuel oil would be used for cold startup and maintenance of low-load flame stability in the boilers. Approximately 5,887 acres of land would be needed for construction and operation of the powerplant.

TABLE 2-12
Alternative 4 - Resource Requirements (Daily Averages)

Project Components	Land ^a (acres)	Water (acre-feet)	Input					Output								
			Coal ^b (tons)	Electricity (MW)	Oil (barrels)	Lime (tons)	Manpower (workers)	Water (acre- feet)	Coal ^b (tons)	Electricity (MW)	Solids (tons)	Liquids (acre- feet)	Wastes			
													SO ₂	Emissions (tons) ^c TSP	NO _x	
CENTRAL UTAH COAL OPTION																
Construction	.....	.....	.....	.....	.....	.....	175	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	9,080	0.95	16,148	.....	348.0	...	2,000	.....	16,148	.....	.....	.....	.....	.....	.....	.....
SOUTHWESTERN WYOMING COAL OPTION ^d																
Construction	.....	.....	.....	.....	.....	.....	300	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	25,340	1.14	.....	.....	620.0	...	640	.....	20,705	.....	.....	.....	.....	.....	.....	.....
HARRY ALLEN POWERPLANT ^e																
Construction	.....	0.35	.....	.....	.....	...	2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	5,887	64.97	16,148	.....	260.0	112	300	.....	.....	1,400	2,399	0.57	15.9	2.44	174.5	.....
Southwestern Wyoming Coal Option																
Construction	.....	0.35	.....	.....	.....	...	2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	5,887	64.97	20,705	.....	260.0	172	300	.....	.....	1,400	3,076	0.57	24.12	3.50	145.3	.....
ELECTRICAL TRANSMISSION SYSTEM																
Construction	8,850	.....	.....	.....	.....	...	150	.....	.....	.....	.....	.....	.....	.....	.....	.....
Operation	229	.....	.....	.....	.....	...	8	.....	.....	.....	.....	.....	.....	.....	.....	.....

Source: NPC, 1975; CU, USDI, USGS, 1979; SW, USDI, BLM, 1978

^a Acreage computed on a 40-year project life.

^b Tonnage of central Utah coal computed with moisture content of 6.1 percent.

^c Emissions tonnage includes sulfur dioxide (SO₂), total suspended particulates (TSP), and nitrogen oxides (NO_x). Calculations made assuming properly functioning control devices. Emission rates are based on maximum operating capacity.

^d Tonnage of southwestern Wyoming coal computed with moisture content of 18.26 percent.

^e Plant operation computed at 70-percent capacity.

NOTE: MW = megawatt

TABLE 2-13

Alternative 4
Land Ownership of Acreage Affected

Component	Affected Acreage	Land Ownership (Percent of Total Acreage)		
		Public	State	Private
Central Utah Coal Option	9,080	85.7	0.0	14.3
Southwestern Wyoming Coal Option	25,340	41.2	1.2	57.6
Harry Allen Powerplant	5,887	98.6	0.0	1.4
Electrical Transmission System				
Allen to Pecos	252	100.0	0.0	0.0
Allen to Eldorado	1,598	77.0	10.5	12.5
Western Transmission System Alternatives				
Interstate Highway 15	7,000	68.0	2.0	30.0
Eldorado-Lugo	7,400	73.0	0.0	27.0
Victorville-McCullough	7,160	73.0	0.0	27.0
Highway 66	9,520	73.5	0.2	26.3

Source: NPC, 1975; SCE and PG&E, 1979

Average water requirements for the plant would be about 31 million gallons per day. The water would be transported to the plant from the Clark County AWT plant in East Las Vegas via a 24.5-mile long buried pipeline.

Solid wastes from the powerplant (ash and scrubber sludge), liquid wastes, and all nonreusable water would be combined to form a slurry and would be pumped to lined slurry disposal ponds. Water would be evaporated from the ponds and as each pond became filled with sludge the top surface would be stabilized to avoid airborne dust. Atmospheric emissions would be controlled by wet-lime scrubbers, electrostatic precipitators, and efficient boiler design according to BACT specifications. Dust from coal and ash would be controlled with the spraying of water and chemicals.

Electrical Transmission System

The proposed transmission system would consist of a network of overhead, high voltage electrical transmission lines that would deliver electricity from the proposed Allen powerplant to the NPC and California utilities' service areas (fig. 2-14). Following is a brief description of each of the proposed lines. Table 2-14 provides a summary of the transmission system.

Allen to Pecos. This system would consist of a double circuit 345-kV line to be constructed between the proposed Harry Allen powerplant and the Pecos substation, located about 8 miles north of Las Vegas. This proposed line would run parallel and adjacent to the west of the existing 230-kV Reid Gardner-Pecos corridor for most of its length. For the first 5 miles it would also run parallel and adjacent to the proposed Allen-Eldorado lines. The total distance covered would be about 16 miles. The line would require a 200-foot wide right-of-way except when paralleling existing lines, then only a 130-foot wide right-of-way would be required. Steel transmission towers 120 feet high would be constructed to accommodate the line.

Allen to Eldorado. The description of this segment would be the same as provided under Alternative 1, consisting of two 500-kV lines, steel lattice towers from 100 to 150 feet high, and 48 miles of right-of-way ranging in width from 130 to 200 feet.

Eldorado to Lugo (Western Transmission System). The two 500-kV lines would be constructed in one of the following four alternative routes or could be separated with one line constructed in each of two of the alternatives: Interstate Highway 15, Eldorado-Lugo, Victorville-McCullough, or Highway 66 (fig. 2-14). The routes and their components are described in Alternative 1 and would be identical to that alternative.

Ancillary Facilities

In addition to the principal components described above, this alternative would involve the construction and operation of various ancillary facilities. One air strip at the Harry Allen powerplant, and five microwave communication stations (at the powerplant, Apex Peak, Nelson, and Spirit Mountain in Nevada, and Clipper Mountain in California) would be constructed.

TABLE 2-14

Alternative 4 Data Summary: Electrical Transmission System

Datum	Western Transmission System Alternatives					
	Allen to Pecos	Allen to Eldorado	Inter- state 15	Eldorado - Lugo	Victor ville - McCullough	Highway 66
Right-of-Way Length (miles)	16	48	175	185	179	238
Transmission Line Length (circuit miles)	16	96	350	370	358	476
Nominal Right-of-Way Width (feet)	130	275	330	330	330	330
Total Right-of-Way (acres)	252	1,598	7,000	7,400	7,160	9,520
New Access and Spur Roads Required (miles)	2	13	117	260	215	327
Permanently Occupied Area ^a (acres)	4	23	202	445	368	560

Source: Compiled from information provided by NPC, 1975; SCE and PG&E, 1979

^aIncludes those areas to be occupied by new access and spur roads, tower footings, and microwave communication sites.

ALTERNATIVE 5

This alternative would involve the implementation of a variety of conservation programs and the development of nonconventional energy sources in the service areas of the participating utilities: city of St. George, NPC, PG&E, and SCE. Scenarios applicable to each specific service or planning area were developed based on existing and projected population and resource availability criteria. Only those levels of implementation that are considered realistic considering the timeframe and existing socioeconomic and political conditions are included in this alternative.

The year 1990 was chosen as a target date that would allow for at least partial implementation of this alternative in the city of St. George and NPC service areas, with full implementation in 2000. The year 1991 was chosen for the PG&E and SCE service areas because the California Energy Commission (CEC) used this year as a target date in their energy demand forecasts and in the analyses of resource plans and supply scenarios that include various levels of energy conservation and the development of alternative energy sources (Biennial Report, 1979). The CPUC Allen-Warner project team also adopted 1991 as a target date for the analysis of energy conservation and the development of alternative energy sources in their draft Environmental Impact Report (EIR, 1980) and "Summary Report of the Allen-Warner Project Team: A Planning Strategy for Electric Supply for PG&E and SCE" (1980).

Scenarios for the city of St. George and NPC service areas are based on information obtained in Energy Conservation Alternative for the Allen-Warner Valley Project, a report prepared under contract for BLM by Centaur Associates, Inc. (1980).

Scenarios for PG&E and SCE service areas are largely based on data relating to these utilities from the "Alternatives Development Scenario" described in CPUC's draft EIR (1980) and "Summary Report" (CPUC, 1980). The scenarios are also based on the "Preferred Resources Supply Mix" as published in the CEC Biennial Report (1979).

The implementation of this alternative would involve a reordering of energy priorities and policies of regulatory authorities and the personal attitudes of the public to support such policy in each of the respective utilities' service areas. New legislation which would further mandate or provide incentives for the conservation of energy and the development of alternative energy sources would have to be enacted on State and local levels to a greater degree in Las Vegas, Nevada and St. George, Utah, and to a lesser degree in California (where much progressive legislation is already in effect).

City of St. George Service Area

There are a number of opportunities for conservation of energy in the St. George service area, but a somewhat lower potential for employing alternative energy sources technologies. Discussions below outline these opportunities, their applicability, relative cost to the consumer, and the relative timeframe required for implementation. The following programs could be partially implemented by the year 1990 and fully implemented by the year 2000.

Conservation and Load Management

Under conservation and load management there are a variety of technologies which could be employed. Moderating thermostat settings for both heating and cooling could be immediately implemented by the residential and commercial/ industrial consumer at virtually no cost. The same would be true of reducing temperature settings on water heaters. These would be relatively passive and voluntary measures. More forceful actions would include installing timed thermostats rather than the conventional strictly temperature activated types. This measure would apply to both space heating/cooling and to water heaters. It would involve some initial expense to the consumer to purchase the devices and have them installed. Another possible technique would be the installation of utility-controlled switches which could turn off air conditioning equipment for selected times during peak power demand periods. As with timed thermostats, these devices would involve some expense, but they could be made available in the short term.

All of the above techniques are technologically applicable in varying degrees to all energy consuming sectors (residential, commercial, and industrial) currently in the St. George service area. Additionally, such measures would be applied more economically to any future construction in the area as standard design features.

Energy consumption in the St. George service area could be further reduced by improving the energy efficiencies of existing and future structures, electrical devices, and appliances. Most efficiency improvements would involve moderate to high cost modifications and would tend to require longer periods of time to implement than would be the case for load-management techniques. However, most of the techniques of improving electrical efficiencies are applicable to all energy consuming sectors. The primary efficiency improvement opportunities in the St. George service area would be:

1. Reduction of heat loss or gain in buildings and appliances (e.g., water heaters) by improving existing levels of insulation. The technique would be applicable to all energy consuming sectors and would generally be of a low to moderate initial expense to the consumer. The amount of time needed to implement such measures would be primarily short term.

2. Conversion to more energy efficient devices by replacing existing appliances and devices with others that are more energy efficient. This would include such methods as converting from compressor driven cooling devices to evaporative coolers, converting from conventional central air conditioning to heat-pump systems, converting from resistance type heating to other systems, replacing existing appliances (refrigerators, clothes washers and dryers, etc.) with more efficient ones, and the use of lower wattage and/or more efficient lighting. These types of changes would be applicable to all energy consuming sectors. Most conversions of the types described would be relatively expensive for the consumer. Therefore, it is most likely that many conversions would only take place as attrition of existing systems occurs, and in the construction of new buildings and facilities. As such, it could be expected that these techniques would take a relatively long period of time to implement.

Alternative Electrical Energy Sources

There are a limited number of opportunities for applying alternative energy sources technologies in the St. George service area. There is insufficient industrial development in the area to consider cogeneration as a viable energy source. Likewise, there is an insufficient quantity of solid waste produced in the St. George service area to supply a biomass powerplant of any consequence. Although geothermal or wind power could provide economical sources of energy in the area, they have not been given consideration in this evaluation because of the lack of data available. This leaves solar energy as the only alternative source considered for development.

There appear to be two general applications for solar energy in the St. George service area. One would be relatively active water heating systems for both domestic uses and for swimming pools. Such systems, although applicable to almost all situations where heated water is needed, would be anticipated to receive highest initial use in the residential sector. Depending upon the type and extent of system employed in any given situation, solar water heating systems are currently moderate to high expense items for the consumer. This is the case partially because such systems still generally require a conventional type of back-up system. Such systems could, however, be either incorporated in future construction or retrofitted to existing structures so their application could be achieved in a relatively short time frame. The second major application of solar energy would be in terms of passive solar space heating and cooling. These systems would primarily be incorporated in new construction, utilizing special orientation and design features to take advantage of radiant energy from the sun in the winter, or shield buildings from the radiant heat of the sun in the summer. As with solar water heaters, solar space heating and cooling is, in concept, applicable to most space conditioning situations, but would be anticipated to receive most of its initial application in the residential sector. Although operational costs would be minimal, structural design and back-up system requirements could involve initially expensive investments. Since solar heating and cooling usually requires special structural design considerations, it would be more easily applied to new construction rather than retrofitting existing structures, and would therefore probably take a longer timeframe to implement.

Energy Savings in 1990 and 2000

It is estimated that if the options of this alternative would be implemented, a reduction in peak demand of 10.6 MW (21.7 percent) would be realized in the St. George service area by 1990. The demand in the year 2000 would be reduced by as much as 27.2 percent, resulting in a reduction of peak demand of 16.9 MW.

Nevada Power Company Service Area

The opportunities for applying energy conservation and alternative energy sources techniques in the NPC service area would be quite similar to those discussed for the city of St. George. Such similarities exist in the categories of conservation, load management, and solar technologies, and will not be discussed again in this section. These programs would be partially implemented by the year 1990 and fully implemented by the year 2000.

Additional opportunities for energy savings in the NPC service area beyond those discussed for St. George would be primarily in alternative energy sources and would involve the cogeneration of electrical energy and the generation of electrical energy from solid waste.

Cogeneration of Energy

The application of cogeneration refers to recovering steam or waste heat produced during industrial processes and using it to generate electrical energy. This process generally only has industrial applications. Cogeneration would involve a relatively long timeframe to implement and could be of only moderate reliability, depending upon the stability of the industry supplying the steam or waste heat.

Generation of Energy from Solid Waste (Biomass Technology)

The possibility of generating electrical energy from the incineration of solid waste in the service area has been explored and such an option could be feasible in the near future. At present, however, there is some question about whether the Las Vegas base population produces sufficient quantities of the appropriate type of solid waste to supply a biomass-fired powerplant, and whether such a power source could compete economically with existing power sources. This energy source therefore is not included in this assessment.

Energy Savings in 1990 and 2000

It is estimated that if the options of this alternative would be implemented, a reduction in peak demand of 221 MW (10.8 percent) would be realized in the year 1990. A reduction of 485 MW (18.8 percent) in peak energy demand could be realized in the year 2000 in the NPC service area.

Pacific Gas and Electric Company and Southern California Edison Service (Planning) Areas

California leads the nation in its promotion of alternative energy sources and conservation measures. State policy is that alternative energy sources such as solar energy, wind, and cogeneration can and should play an increasingly important role in meeting energy needs. In its Biennial Report (1979), CEC states that "[Geothermal, cogeneration, and renewable energy sources including solar] are available now. They should be expanded because of their favorable environmental characteristics, efficiency, more stable costs, and the fact that they are indigenous to California." Likewise, CPUC has clearly stated its support for conservation and nonconventional energy sources. The two commissions, the State Legislature, and the Governor place energy conservation as one of the top energy priorities.

The CPUC Allen-Warner project team analyzed the feasibility of various alternatives for meeting California's future energy needs in their draft EIR (1980) and their "Summary Report" (1980). These assessments include a comparative analysis of these alternatives and are used in the analysis of Alternative 5 for the service areas of the California utilities in the final AWV environmental impact statement. The EIR (scheduled for release in final form in December 1980) is available from CPUC and may be obtained by writing to:

California Public Utilities Commission
Allen-Warner Valley Project
1390 Market Street
Fox Plaza, Room 724
San Francisco, California 94102

The following information concerning the PG&E and SCE service areas is largely based on data from CPUC staff's draft EIR and "Summary Report" (1980), and on information contained in several CEC reports.

Three basic types of programs are considered in this alternative:

1. The development of alternative electrical energy sources. Certain amounts of these technologies are already in the utility supply mixes, and additional capacity is included in current resource plans.

2. Reduction in the demand for electricity through substitution of direct heat obtained from renewable energy sources (solar technology) or its deflection (shading).

3. Reduction in the demand for electricity through conservation and load-management measures. Steps which result in less energy being required by a given process fall under the heading of conservation, while various load-management practices would be aimed at reducing system demands during periods of peak consumption.

Alternative Electrical Energy Sources

The analysis of various alternative electrical energy sources options presented in this section is based on CPUC staff assessments as presented in their draft EIR (1980) and in their "Summary Report" (1980).

Only the realistic capabilities of alternative energy sources to supplant capacity represented by the AWV project are analyzed. The potential capacities which could be installed by 1991 (based on technical, economic, and other feasibility criteria) and which are not assumed in the resource plans of PG&E and SCE are considered in the analysis.

The alternative energy sources mix for 1980 and 1991 specified by PG&E and SCE for their service areas is outlined in tables 2-15 and 2-16. Formulation of the 1991 "Feasible Alternative Energy Sources Mix" for PG&E and SCE as outlined in tables 2-15 and 2-16 are based on the CPUC staff's "Alternatives Development Scenario" (draft EIR, 1980). CPUC staff assessments are subject to change pending the CPUC proceedings in the granting of a Certificate of Public Convenience and Necessity for PG&E and SCE for their participation in AWV. Application of the "Feasible Mix" would result in an additional 1,498 MW of electrical generating capacity from nonconventional sources for PG&E, and 577 MW for SCE over and above the utilities' resource plans.

Substitution of Direct Renewable Energy for Electricity: Solar Energy

Reduction of the end-use demand for electricity through the direct use of renewable energy sources could be achieved in several ways. Direct combustion of biomass forms such as agricultural and forestry residues,

TABLE 2-15

Electrical Energy From Alternative Sources:
PG&E Service Area (Firm Capacity - Megawatts)

	Utility Resource Plan		Feasible Alternative Energy Sources Mix for 1991 (MW)	Potential Not in Current Utility Resource Plans (MW)
	1980 Capacity (MW)	1991 Capacity (MW)		
Cogeneration, Solid Wastes, and Biomass ^a	188	1,240	2,228	988
Geothermal	908	2,159	2,357	198
Hydro (adverse year)	5,335	6,553	6,553	0
Wind ^b	0	48	160	112
Solar (Photo- voltaics and Thermal- Electric)	<u>0</u>	<u>0</u>	<u>200</u>	<u>200</u>
Total	6,431	10,000	11,498	1,498

Sources: Proponents' Environmental Assessment, SCE and PG&E, 1979, as modified in the testimony of R. Bruce Williams, Senior Engineer for PG&E, CPUC Hearings for Certificate of Public Convenience and Necessity, July 1980; Draft Environmental Impact Report, CPUC, 1980; "Summary Report of the Allen-Warner Project Team: A Planning Strategy for Electric Supply for PG&E and SCE," CPUC, 1980

^aInstalled capacity of cogeneration is assumed as firm.

^bFirm capacity of wind energy sources is 0.33 that of installed capacity.

TABLE 2-16

Electrical Energy From Alternative Sources:
SCE Service Area
(Firm Capacity - Megawatts)

	Utility Resource Plan		Feasible Alternative Energy Sources Mix for 1991 (MW)	Potential Not in Current Utility Resource Plans (MW)
	1980 Capacity (MW)	1991 Capacity (MW)		
Cogeneration ^a	36	354	600	246
Geothermal	0	166	170	4
Hydro (adverse year)	875	929	959	30
Wind ^b	0	63	160	97
Fuel Cells	0	26	26	0
Solar (Photo- voltaics and Thermal- Electric)	<u>0</u>	<u>0</u>	<u>200</u>	<u>200</u>
Total	911	1,372	2,115	577

Sources: Proponents' Environmental Assessment, SCE and PG&E, 1979, as modified in the testimony of S.P. Barrett, Senior Engineer for SCE, CPUC Hearings for Certificate of Public Convenience and Necessity, July 1980; Draft Environmental Impact Report, CPUC, 1980; "Summary Report of the Allen-Warner Project Team: A Planning Strategy for Electric Supply for PG&E and SCE," CPUC, 1980

^aInstalled capacity of cogeneration is assumed as firm (SCE considers firm capacity of cogeneration as 0.33 of installed capacity).

^bFirm capacity of wind energy sources is considered 0.33 that of installed capacity.

NOTE: SCE has recently announced a new corporate policy to accelerate the development of renewable (alternative) energy sources (i.e., hydroelectric, geothermal, solar-electric, cogeneration, wind, and fuel cells (SCE Press Release, October 17, 1980). A discussion of this new policy is included in the Existing and Projected Electrical Energy Sources Mix section of Chapter 3. The capacity represented in the new policy is not included in this analysis because it has not yet been officially presented to the California Commission as part of the SCE resource plan (personal communication, S.P. Barrett, Senior Engineer for SCE, October 21, 1980).

municipal solid wastes, or wood could supply energy for space and water heating and for industrial processes. In addition to its use for electricity generation, geothermal steam could be used directly for a variety of domestic and industrial purposes, the most common being the heating of buildings and industrial drying. However, solar energy, in its various forms, would present the greatest potential in the near-term to displace electricity demand, and is the only renewable energy source potential that is included in this analysis.

The assessment of direct solar technologies is based on information from the CEC document Decade of the Sun: Program Plan for the Maximum Implementation of Solar Energy Through 1990 (1980), and CPUC staff's draft EIR (1980). In producing this document, CEC assessed the status and potential of solar technologies in the residential, commercial, industrial, and agricultural sectors. It limited the scope of its study to those direct uses of solar energy for heating water; space heating and cooling; lighting buildings; process heating; mechanical pumping; and the production of electricity. Each solar application was studied for technical feasibility, commercial readiness, cost effectiveness, and the amount of energy that could be supplied by 1990 (data only available to 1990).

For the residential sector, CEC determined the maximum number of residences for which it would be both technically and economically feasible to incorporate solar applications by 1990. The energy savings possible due to passive solar cooling and active water heating were assessed for new construction, retrofit applications, and for single-family and multi-family homes, and associated reduction in peak demand was computed.

The commercial sector is composed of a diverse group of energy users. Sufficient data was not available to allow assessment of the potential applications of solar energy in this sector to the level of detail and accuracy possible in the residential sector. Solar energy potentials were estimated, however, for both new and existing commercial consumers for the uses of space cooling, service (potable) water heating, and lighting.

While the CEC document contains discussions of a number of potential applications of solar technologies in the industrial and agricultural sectors, no estimates of potential savings nor of how much existing use of conventional fuels could be displaced in these two sectors are discussed in this assessment.

The maximum displacement of electricity demand as determined by CEC for the residential and commercial sectors in the PG&E and SCE service areas is shown in table 2-17. While it is probably unrealistic to expect that these maximum savings would be achieved, a substantial portion could be realized, especially with the major promotional efforts proposed and already in effect in California. If half the maximum level on the lower end would be achieved, it would result in a reduction in peak demand in the two utilities' service areas of 975 MW in 1990.

Conservation and Load Management

The amount of energy savings that would result from conservation measures (included in the CEC forecast of energy demand adopted by CPUC in table

TABLE 2-17

1990 Maximum Annual Reduction in Peak Demand
Due to Direct Solar Energy

	PG&E (MW)	SCE (MW)
Residential Space Cooling	920 - 1,180	500 - 680
Residential Water Heating	40	90
Commercial Space Cooling, Water Heating, and Natural Lighting	<u>170 - 330</u>	<u>230 - 480</u>
Total	1,130 - 1,550	820 - 1,250

Source: Decade of the Sun: Program Plan for the Maximum Implementation of Solar Energy Through 1990, Committee Report, CEC, 1980; Draft Environmental Impact Report, CPUC, 1980

2-18) represents an assumption of the reductions in energy demand that would occur in the PG&E and SCE service areas. Obviously, the potential demand reductions that could result from an all-out nationwide conservation effort by utilities, government, industry, and consumers would be substantially higher. The "high conservation scenario" (table 2-18) examines energy savings that would result from these additional conservation measures that could be realized within the next 10 years.

It should be noted that the CEC adopted forecast does not consider any conservation measure not already enacted. California law requires that the CEC forecast include all conservation that would be "reasonably likely" to occur. This requirement was interpreted to mean all actions that have been promulgated by CEC, CPUC, and the U.S. Department of Energy at the time of the forecast.

The CEC adopted forecast of electricity demand includes the demand reducing measures presented in table 2-18. In addition, the CEC staff also analyzed the effects of the "high conservation scenario," which also appears in the table. The rigorous implementation of those measures included under the "high conservation scenario" as presented in table 2-18 would result in a reduction in peak demand of 1,490 MW in the PG&E service area, and a reduction in peak demand of 1,237 MW in the SCE service area over and above the adopted forecast (personal communication, Darrell Joyner, CEC, May 12, 1980; draft EIR, CPUC, 1980). The "high conservation scenario" does not assess the impacts of such conservation measures as residential energy audits, commercial load management, industrial boiler efficiency standards, and agricultural pump efficiency standards. All these measures would tend to reduce energy demand even further beyond the elements included in the scenario. Adjustments have been made for solar displacement originally assumed in the scenario. This displacement is now assumed in the preceding section on solar displacement (table 2-17).

ALTERNATIVE 6

This "No Action" alternative would involve the denial by Federal land managers of rights-of-way and other appropriate permits necessary for the construction and operation of the proposed AWV energy system. It is assumed for analysis purposes that if this alternative would be implemented, Alternative 1 through 5 or any combination of these alternatives would not be implemented. In the absence of the proposed project, the project sponsors could take a wide variety of possible actions. Included in the following section is one possible option the project sponsors might choose to follow. This option is included as an example of what might occur as a result of implementing the no action alternative. The example used is BLM's estimation of the AWV energy system participants' most likely course of action and does not represent a specific proposal by the participants.

Washington County Water Conservancy District

Rejection of the proposed reservoir could result in the Conservancy District resubmitting a modified reservoir proposal. This proposal would probably be a scaled down version of the existing proposal, designed to reflect a reduced funding potential. However, the essential design elements would probably be very similar to the existing proposal.

TABLE 2-18

Demand Reducing Measures Included in CEC Forecast Adopted by CPUC
and CEC High Conservation Scenario

Measure	Adopted Forecast	Forecast with CEC High Conservation Scenario
<u>Residential</u>		
Building standards	Present CEC standards	Baseline
Appliance efficiency		
CEC standards	Present CEC standards	More efficient standards
Federal standards	Enacted in 1981	Baseline
Pool and water heater load management	8 percent of pools	80 percent by 1995
Air conditioning load management	8 percent of central air conditioning	80 percent by 1995
Insulation retrofit	Utility programs	100 percent by 1990
Solar water heaters (Electric backups)	50 percent of all homes in nongas regions; 0.5 percent of all homes in gas regions	90 percent of all new homes in nongas regions; 90 percent of new multi- family units in gas regions
<u>Commercial</u>		
Building standards	Present CEC standards	Baseline
Utility audit programs	Pre-1980 buildings only	Up to 20 percent savings
Appliance efficiency standards	Present CEC standards	More efficient standards
Lighting standards	Office/miscellaneous buildings only	Baseline
Solar water heating	All new State buildings	Baseline
Street light upgrading	Conversion to sodium vapor	Faster conversion
<u>Industrial</u>		
Building standards	Present CEC standards	Baseline
Utility audit programs	Utility estimates	20-percent savings
<u>Voltage Reduction</u>	Utility estimates	Greater impacts

Source: Energy Futures for California: Two Scenarios, 1978-2000, Staff
Draft, CEC, 1979

In order to meet industrial and municipal water needs, area municipalities could construct additional water storage tanks to increase present storage capacity. This could allow the municipalities to better meet their peak culinary water needs through the year 2000 using existing water supply sources (see Purpose and Need of Proposed Project section in Chapter 1).

Other acceptable methods of obtaining additional culinary water supplies when needed could include the drilling of new wells or the upgrading of existing ones to better utilize ground water resources and programs of water conservation.

City of St. George

St. George would probably seek to increase the amount of power it presently receives from the Western Area Power Administration. If sufficient power would be unavailable from this source, the city could then seek approval from the Utah Public Service Commission for a temporary purchase of power from Utah Power and Light Company and continue its efforts to participate (shared ownership) in any new regional power generating stations. One such new facility is the Palo Verde nuclear generating plant near Phoenix, Arizona. Layoff power or ownership shares could be made available from the Arizona Public Service Company or the Salt River Project provided a proper transmission system interconnection would be available.

The city would probably attempt to develop a new transmission connection between its system and its current power supplier (Utah Power and Light Company) or from its power deliverer (CP National). (Power is delivered over CP National's transmission lines to St. George from Utah Power and Light and the Western Area Power Administration.) This powerline would provide for increased transmission and would insure system reliability.

The city of St. George could also seek to develop an interconnection in cooperation with several nearby communities, which are participants in the Intermountain Power Project, or try to accelerate CP National's proposal to convert an existing 69-kV line to 138 kV. A CP National spokesman (personal communication, Wallace K. Smith, Electrical Engineer, September 25, 1980) has indicated that by 1985 the existing 69 kV transmission line from Cedar City to LaVerkin will be upgraded to 138 kV. This line, when connected to the St. George system, would be able to transmit an additional 20 to 30 MW. This increased transmission capacity should be sufficient to meet St. George's transmission capacity needs until 1990 or beyond.

Nevada Power Company

NPC could start negotiations to meet their short-term energy needs through the purchase of any available power supplies. Potential sources could include capacity presently available from the Arizona Public Service Company and the Salt River Project for power from the Palo Verde Nuclear Generating station, or the purchase of layoff power from the Intermountain Power Project.

Concurrent with this action, NPC could continue its historical practice of participating with other utilities in the development of coal-fired powerplants. Their most likely choice would be the California Coal project, which

is presently undergoing review by CEC. The facility would be located at one of five potential sites in southern California (Ivanpah, Ormand Beach, Cadiz, Rice, or Boron). It would produce 1,500 MW of power using coal from Arizona, Utah, or Wyoming, with some 260 MW of capacity allocated to NPC (personal communication, John Arlidge, Special Projects Manager, NPC, January 16, 1980).

Southern California Edison Company

This California utility could attempt to accelerate the development of the proposed California Coal project noted above. An expedited regulatory review would probably be requested from the CEC.

Pacific Gas & Electric Company

PG&E could attempt to accelerate the development of their proposed Montezuma 1 and 2 project, presently scheduled for service in 1989. This facility would consist of 1,600 MW of coal-fired capacity. Coal for this powerplant would be obtained from central Utah and shipped by rail to the powerplant site. The powerplant would be located in the Sacramento River Delta region of northern California.

AUTHORIZING ACTIONS

In order to implement either the applicants' proposed project or any one or parts of the alternatives, certain Federal, State and local authorizing actions must be taken. Appendix 5 lists these actions and indicates how they would apply to the applicants' proposal and alternatives listed in this EIS.

STANDARD OPERATING PROCEDURES AND MITIGATING MEASURES

Certain standard operating procedures and mitigating measures are required by BLM as a condition to receipt of approval to utilize public lands. The standard operating procedures are designed to minimize the general impacts of construction and operation activities associated with the implementation of any one or parts of the alternatives (excluding coal fields). Mitigating measures are designed to avoid or minimize impacts that are specific to an alternative. A list of the standard operating procedures and mitigating measures is provided in Appendix 6.

COMPARATIVE ANALYSIS OF ALTERNATIVES

Table 2-19 presents a cumulative summary of the impacts of major concern which would be brought about with the implementation of each of the alternatives, including the proposed action. Based on this table, the following is a discussion of the comparative significance of the impacts of each alternative by environmental (resource) element.

TABLE 2-19
Cumulative Summary of Major Impacts

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
ENERGY					
Total average electrical output would be 1,750 MW, further reduced by an 8-percent line loss to 1,610 MW.	Total average electrical output would be 1,400 MW, further reduced by an 8-percent line loss to 1,288 MW.	Total average electrical output would be 875 MW, further reduced by an 8-percent line loss to 805 MW.	Total average electrical output would be 1,400 MW, further reduced by an 8-percent line loss to 1,288 MW.	Total capacity represented by energy savings and displacement would be equal to 5,777 MW.	Continued use of as much as 14 million barrels of oil annually in California powerplants.
Overall energy efficiency would be 22.1 percent.	Overall energy efficiency would be 22.1 percent.	Overall energy efficiency would be 23.4 percent with central Utah coal, or 23.3 percent with southwestern Wyoming coal.	Overall energy efficiency would be 24.0 percent with central Utah coal, or 23.8 percent with southwestern Wyoming coal.	Use of essentially renewable energy sources would be highly energy efficient (although not quantifiable).	
AIR QUALITY					
Total powerplant emissions emitted into the atmosphere (tons per day) would be: Warner Valley - 2.04 TSP, 10.38 SO ₂ , 34.30 NO _x ; Harry Allen - 8.16 TSP, 40.80 SO ₂ , 136.22 NO _x . The allowable PSD Class I increments for SO ₂ would be exceeded at Zion National Park.	Total powerplant emissions emitted into the atmosphere (tons per day) would be: Harry Allen - 8.16 TSP, 40.80 SO ₂ , 136.22 NO _x . Allowable PSD Class II increments for SO ₂ and TSP would be exceeded near the Harry Allen powerplant site. NAAQS standards would be exceeded for SO ₂ and NO _x near the Harry Allen powerplant site. Dust plumes from mining activities in the Alton East coal lease area would be visible from Yovimpa Point in Bryce Canyon National Park.	Total powerplant emissions emitted into the atmosphere (tons per day) would be: Warner Valley - 1.02 TSP, 5.19 SO ₂ , 17.15 NO _x ; Harry Allen using central Utah coal - 1.22 TSP, 7.95 SO ₂ , 87.20 NO _x ; Harry Allen using southwestern Wyoming coal - 1.75 TSP, 12.06 SO ₂ , 72.66 NO _x . Allowable PSD Class II increments for SO ₂ would be exceeded near the Harry Allen powerplant site should central Utah coal be used. Allowable PSD Class II increments for SO ₂ and TSP would be exceeded near the Harry Allen powerplant site should southwestern Wyoming coal be used.	Total powerplant emissions emitted into the atmosphere (tons per day) would be: Harry Allen using central Utah coal - 2.44 TSP, 15.90 SO ₂ , 174.90 NO _x ; Harry Allen using southwestern Wyoming coal - 3.50 TSP, 24.12 SO ₂ , 145.32 NO _x . Allowable PSD Class II increments for SO ₂ and TSP would be exceeded should central Utah coal be used. Allowable PSD Class II increments for SO ₂ and TSP would be exceeded should southwestern Wyoming coal be used. NAAQS standards for SO ₂ and TSP would be exceeded should southwestern Wyoming coal be used.	Possible impacts with the development of co-generation (including biomass) and geothermal energy sources, depending on level and location of implementation. Continued operation of oil-fired powerplants would produce an undeterminable amount of pollutants. Development of other coal-fired energy projects (if pursued) would emit particulate matter, sulfur dioxide, nitrogen oxides, and other pollutants in undeterminable amounts.	

(continued)

TABLE 2-19 (continued)

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
WATER RESOURCES					
About 20 springs with an average annual yield of 132 acre-feet would be altered or destroyed in the Alton area.	About 20 springs with an average annual yield of 132 acre-feet would be altered or destroyed in the Alton area.	Surface water quality in central Utah or southwestern Wyoming and the Alton mine areas would be adversely affected.	Surface water quality in central Utah or southwestern Wyoming mine areas would be adversely affected.	Possible impacts to existing water users depending on location and design of hydroelectric developments.	Future development of other energy projects (if pursued) could affect water resources, depending on the water source used.
On-site erosion would be increased on a total of 10,154 acres and downstream sedimentation would be increased although the acreage affected at any one time would be less.	On-site erosion would be increased on a total of 10,154 acres and downstream sedimentation would be increased although the acreage affected at any one time would be less.	Up to 20 springs in the Alton mine area would be altered or destroyed and erosion and stream sedimentation would be increased.	Characteristics of underground aquifers would be altered temporarily, adversely impacting yields of springs and wells in adjacent areas.	The implementation of geothermal projects could create impacts to water quality due to increased sedimentation.	
Ground water pumping could adversely affect well and spring yields in adjacent valleys.	Ground water pumping could adversely affect well and spring yields in adjacent valleys.	Yields of spring and well water sources in adjacent areas would be adversely affected in the central Utah coal fields.	About 1,850 acres of Dry Lake playa would be occupied by Allen powerplant facilities, raising potential flood levels.		
Stream flow and water quality would be reduced in Virgin River.	About 1,850 acres of Dry Lake playa would be occupied by Allen powerplant facilities, raising potential flood levels.	Stream flow and water quality would be reduced in the Virgin River.			
About 1,850 acres of Dry Lake playa would be occupied by Allen powerplant facilities, raising potential flood levels.	About 1,850 acres of Dry Lake playa would be occupied by Allen powerplant facilities, raising potential flood levels.	About 1,850 acres of Dry Lake playa would be occupied by Allen powerplant facilities, raising potential flood levels.			
VEGETATION					
The continued existence of one endangered plant would be jeopardized.	No significant impact.	The continued existence of one endangered plant would be jeopardized.	No significant impact.	Some vegetation communities could be impacted with inundation associated with hydroelectric developments or clearing associated with the harvesting of solid wastes (wood).	Future development of other energy projects (if pursued) could have adverse impacts.
WILDLIFE					
The habitat of one animal threatened in Utah and protected in the States of Arizona, Nevada, and California would be disturbed.	The habitat of one animal threatened in Utah and protected in Arizona, Nevada, and California would be disturbed.	The habitat of one animal threatened in Utah and protected in Arizona, Nevada, and California would be disturbed.	The habitat of one animal threatened in Utah and protected in Arizona, Nevada, and California would be disturbed.	Possible impacts or habitat losses could occur with hydroelectric developments or the harvesting of solid wastes (wood).	Future development of other energy projects (if pursued) could have adverse impacts.
The continued existence of one endangered fish would be jeopardized.		The continued existence of one endangered fish would be jeopardized.			

(continued)

TABLE 2-19 (continued)

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
CULTURAL RESOURCES					
About 348 archaeological sites could be adversely impacted.	About 313 archaeological sites could be adversely impacted.	About 183 archaeological sites could be adversely impacted with use of central Utah coal, or 440 sites with use of southwestern coal.	About 130 archaeological sites could be adversely impacted with use of central Utah coal, or 645 sites with use of southwestern Wyoming coal.	Impacts could occur, depending on type and location of project.	Future development of other energy projects (if pursued) could have adverse impacts.
The historic Honeymoon, Temple, and Dominguez-Escalante Trails would be adversely impacted.	The Honeymoon Trail (non-Registered) would be adversely impacted.	The historic Honeymoon, Temple, and Dominguez-Escalante Trails would be adversely impacted.			
The Hurricane Canal/Diversion, currently listed on the National Register, would be physically destroyed.		The Hurricane Canal/Diversion, currently listed on the National Register, would be physically destroyed.			
RECREATION AND AESTHETICS					
Recreation and aesthetics values would be degraded at Bryce Canyon National Park due to noise and visual intrusions as a result of mining activities in the Alton East coal lease area. Blasting from mining activities could be perceived as being 64 times louder, and truck noise 2 to 16 times louder than natural background levels.	Recreation and aesthetics values would be degraded at Bryce Canyon National Park due to noise and visual intrusions as a result of mining activities in the Alton East coal lease area. Blasting from mining activities could be perceived as being 64 times louder, and truck noise 2 to 16 times louder than natural background levels.		A decrease in overall visual resources quality would occur throughout the affected environment.	Impacts could occur, depending on type and location of project.	Future development of other energy projects (if pursued) could have adverse impacts.
A decrease in overall visual resources quality would occur throughout the affected environment.	A decrease in overall visual resources quality would occur throughout the affected environment.	A decrease in overall visual resources quality would occur throughout the affected environment.			
Impacts to visibility brought about by emissions from the Warner Valley powerplant could adversely impact the recreation and aesthetics values at Zion National Park.		Impacts to visibility brought about by emissions from the Warner Valley powerplant could adversely impact the recreation and aesthetics values at Zion National Park.			
Violation of BLM Wilderness Study Areas would occur with three of four alternative routes of the Western Trans-mission System in southern California.	Violation of BLM Wilderness Study Areas would occur with three of four alternative routes of the Western Trans-mission System in southern California.	Violation of BLM Wilderness Study Areas would occur with three of four alternative routes of the Western Trans-mission System in southern California.	Violation of BLM Wilderness Study Areas would occur with three of four alternative routes of the Western Trans-mission System in southern California.	Impacts could occur, depending on type and location of project.	Future development of other energy projects (if pursued) could have adverse impacts.
WILDERNESS					
					(continued)

TABLE 2-19 (concluded)

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
LAND USE					
Changes in existing uses would occur on 24,752 acres.	Changes in existing uses would occur on 17,351 acres.	Changes in existing uses would occur on 19,096 acres with use of central Utah coal, or 27,226 acres with southwestern Wyoming coal.	Changes in existing uses would occur on 15,196 acres with use of central Utah coal, or 31,456 acres with use of southwestern Wyoming coal.	Possible conflicts with existing land uses could occur with the development of hydroelectric, geothermal, solar, and wind energy sources.	Should other energy projects be developed, conflicts with existing land uses could occur.
Zoning changes would be required in the Alton coal lease area, at the Warner Valley and Harry Allen powerplant sites, and in the city limits of Henderson, Nevada.	Zoning changes would be required in the Alton coal lease area, at the Warner Valley and Harry Allen powerplant sites, and in the city limits of Henderson, Nevada.	Zoning changes would be required in the Alton coal lease area, at the Warner Valley and Harry Allen powerplant sites, and in the city limits of Henderson, Nevada.	Zoning changes would be required at the Harry Allen powerplant site and in the city limits of Henderson, Nevada.		
SOCIOECONOMICS					
<u>Kane County</u> Population 2,666 Employment 1,062 Income \$20,228,700	<u>Kane County</u> Population 2,666 Employment 1,062 Income \$20,228,700	<u>Central Utah Region</u> Population 52,000 Employment 22,120 Income \$520,650,000	<u>Central Utah Region</u> Population 52,000 Employment 22,120 Income \$520,650,000	A lowering of overall energy costs to consumers would result as a result of decreasing energy demand.	The continued dependence on oil resources would lead to unstable powerplant fuel prices and an unstable electricity costs structure.
<u>Washington County</u> Population 8,013 Employment 2,244 Income \$29,198,300	<u>Clark County</u> Population 8,776 Employment 4,230 Income \$74,790,000	<u>Southwestern Wyoming Region</u> Population 11,601 Employment 4,195 Income \$600,700,000	<u>Southwestern Wyoming Region</u> Population 11,601 Employment 4,195 Income \$600,700,000	Some shifts and/or expansions in employment would occur.	Temporary restrictions could occur on the ability of St. George to attract industry and provide for community base expansion.
<u>Clark County</u> Population 8,776 Employment 4,230 Income \$74,790,000	<u>Kane County</u> Population 783 Employment 563 Income \$10,734,900	<u>Clark County</u> Population 8,776 Employment 4,230 Income \$74,790,000	<u>Clark County</u> Population 8,776 Employment 4,230 Income \$74,790,000	Changes in current lifestyles would occur as consumers change patterns of energy use towards reduced consumption.	Temporary power shortages in St. George and Las Vegas could occur.
<u>Washington County</u> Population 8,103 Employment 2,244 Income \$21,400,000	<u>Clark County</u> Population 8,776 Employment 4,230 Income \$74,790,000				
^a 1990 projection					
^b total personal income					
NOTE:			PSD = Prevention of Significant Deterioration NO _x = nitrogen oxides		
			SO ₂ = sulfur dioxide TSP = total suspended particulates NAAQS = National Ambient Air Quality Standards		

Air Quality

The impacts to air quality and related values would be most significant with the implementation of Alternative 1. Based on modeling by the Environmental Protection Agency (EPA) Region VIII (EPA Valley screening model), both the Prevention of Significant Deterioration (PSD) Class II sulfur dioxide (SO_2) standards at Sand Mountain and Class I SO_2 standards at Zion National Park would be exceeded. Visibility at Zion National Park could be adversely impacted and EPA Region VIII has proposed denial of the Warner Valley PSD permit. Class II SO_2 and total suspended particulates as well as National Ambient Air Quality (NAAQS) SO_2 and NO_x standards would be exceeded in the Dry Lake, Nevada area by emissions from the Harry Allen powerplant based on EPA Region IX Valley screening modeling. Unless it can be shown by more sophisticated modeling, better control efficiency, smaller plant size, plant relocation, or a combination of these, that the PSD standards and NAAQS can be met, PSD permits cannot be granted by EPA.

PSD Class II and Class I standards would also be exceeded under Alternatives 2, 3, and 4, but the overall impact to air quality would be less than under Alternative 1 because of elimination of a component (i.e., Warner Valley in Alternative 2 and 4) or a reduction in plant size (Alternative 3).

Impacts to local air quality could occur with the implementation of geothermal and cogeneration projects under Alternative 5, depending on the location of the facilities; however, these impacts are generally considered to be less than Alternatives 1 through 4. Alternative 6 could have an impact on air quality should the project applicants decide to construct a powerplant in another location.

Water Resources

Surface mining at Alton as proposed in Alternatives 1 and 2, and in southwestern Wyoming in Alternatives 3 and 4 would alter local surface and ground water quality and quantity for the life of the project and until land could be reclaimed and watersheds regenerated. Underground mining at Alton under Alternatives 2 and 3 and at central Utah under Alternatives 3 and 4 would have a less significant effect.

The diversion of Virgin River water for the Warner Valley water project would lower the quality of the river, resulting in a 38-percent reduction in flow and a 35-percent increase in total dissolved solids (salts) in the river under Alternative 1. In comparison, under Alternative 3 there would be a 24-percent reduction in flow and a 30-percent increase in total dissolved solids in the river.

The impounding of waters for hydroelectric purposes under Alternative 5 could conflict with other water uses, depending on the location and design of potential dams. Alternative 6 could have an impact on other resources should project applicants choose to construct other energy projects in other locations. The procurement of water for these projects could impact existing water uses.

Vegetation: Species of Concern

Significant impacts to vegetation would be those to threatened or endangered plants. Under Alternatives 1 and 3, the implementation of the Warner Valley powerplant and water project would threaten the continued existence of the dwarf bearclaw poppy (Arctomecon humilis), an endangered plant, with the only known habitat within a 6-mile radius of St. George, Utah. Implementation of Alternatives 2, 4, 5, and 6 would not significantly impact any known threatened or endangered plant species.

Wildlife: Species of Concern

Significant impacts to wildlife would be those to threatened or endangered species. The implementation of the Warner Valley water project as designed in Alternative 1 would jeopardize the continued existence of the endangered woundfin minnow (Plagopterus argentissimus) with the only known habitat being the Virgin River from LaVerkin Springs, Utah to Lake Mead, Nevada. The water project included in Alternative 3, although designed to divert less water from the Virgin River, would also jeopardize the continued existence of the endangered fish. Implementation of Alternatives 2, 4, 5, and 6 would not significantly impact any known threatened or endangered animal species.

Cultural Resources

Although extensive cultural resources inventories (archaeology, history) have not been completed to determine the actual number and significance of cultural sites for all components of the alternatives, a standard professional estimate is used where data is lacking to assess the potential for impacts to cultural resources. Impacts to cultural resources would be most significant with the implementation of Alternative 1, under which three historic trails would be adversely impacted, one National Register property would be destroyed, and as many as an estimated 348 cultural sites could be affected.

In comparison, under Alternative 2 only 313 cultural sites could be impacted and one historic trail would be impacted. Depending on the coal source used under Alternative 3 from approximately 183 sites (central Utah coal source) to as many as 440 sites (southwestern Wyoming coal source) could be affected, with one known National Register property destroyed and three historic trails adversely impacted.

Under Alternative 4, from approximately 130 sites (central Utah coal source) to as many as 645 sites (southwestern Wyoming coal source) could be adversely impacted. Several cultural resources sites could be impacted with the implementation of Alternative 5, depending on the type and location of specific projects. No known cultural resources would be impacted under Alternative 6.

Recreation and Aesthetics

Major impacts to recreation and aesthetics would primarily be those that would impact national parks. Under Alternatives 1 and 2 there would be significant adverse impacts (including noise, visual intrusion, impacts to

visibility) to the recreation and aesthetics values of Bryce Canyon National Park due to mining activities in the Alton coal lease area. Also under Alternative 1, emissions from the Warner Valley powerplant would impact air quality related values (visibility) in Zion National Park. This impact could also occur under Alternative 3, although to a lesser degree because of a smaller-sized powerplant. The placement of the coal slurry pipeline and ancillary facilities as designed under Alternatives 1 and 2 would impact the natural character of the historic Honeymoon Trail.

Wilderness

The placement of the coal slurry pipeline as designed under Alternatives 1 and 2 would impact BLM Intensive Wilderness Inventory Units. Should these units be designated as Wilderness Study Areas, then the placement of a pipeline would be prohibited under interim management policy guidelines. If dropped from consideration, rights-of-way would be permissible. The Warner Valley powerplant site as designed in Alternatives 1 and 3 would be located over a portion of an Intensive Wilderness Inventory Unit.

Three of the four alternative routes for the western transmission system as designed in Alternatives 1, 2, 3, and 4 would cross BLM Wilderness Study Areas. Crossing these areas would be in conflict with the BLM regulations for "interim management" for Wilderness Study Areas. No known wilderness related areas would be impacted under Alternatives 5 and 6.

Land Use, Land Use Plans and Controls

The significance of impacts to current land use is proportional to the total amount of acreage affected. There would be changes from current land uses to project uses on approximately 24,752 acres over the project life under Alternative 1. This compares to a change in 17,351 acres under Alternative 2, a change in from 19,096 to 27,226 acres in Alternative 3; and a change in from 15,196 to 31,456 acres in Alternative 4 for the life of the project. Most components under Alternatives 1 through 4 would require revisions to current land use controls or zoning laws, with Alternative 1 requiring the most revisions. Surface mining of approximately 600 acres in the Alton coal lease area as proposed in Alternatives 1 and 2 would be in violation of BLM's Zion Planning Unit Management Framework Plan Summary for Coal Management.

Some impacts to current land uses would occur with the implementation of Alternative 5, depending on the specific location of projects. No known impacts to land use would occur under Alternative 6.

Socioeconomics

Alternative 1 would generate the most significant impacts in the southern Utah region. This alternative would entail the greatest changes in population, employment and income bases, demands for infrastructural services, and the region's quality of life. Of the two counties in the region, Kane County would be likely to incur the most significant impacts. Alternative 3 would also impact southern Utah communities, but to a lesser degree due to the scaling down of project components. It is not anticipated that either Alternative 5 or 6 would have a major socioeconomic impact on the southern Utah region.

The southern Nevada region would probably be most significantly affected by implementation of Alternatives 1 or 4, although the socioeconomic effects of Alternatives 2 and 3 would be only slightly less. The analysis indicates, however, that it is not likely that significant socioeconomic impacts would occur in the Nevada area as a result of any of Alternatives 1 through 4 when compared to baseline projected growth in the region. Through changes in building codes and some modification of lifestyles in the southern Nevada region, Alternative 5 would generate some socioeconomic impacts, but it is anticipated that these would be of less significance than those of Alternatives 1 through 4. It is not anticipated that Alternative 6 would generate significant impacts in the southern Nevada region.

Depending on the coal source, the central Utah or the southwestern Wyoming regions would be most affected by Alternatives 3 and 4. Based on the amount of coal required, Alternative 4 would generate the most significant socioeconomic impacts, but such impacts would occur in combination with other developments that would be taking place at the same time and would therefore be difficult to distinguish as attributable solely to the AWV project. Alternatives 5 and 6 would have no effect on either the central Utah or southwestern Wyoming regions.

As discussed above, the level and intensity of socioeconomic impacts for each region would vary considerably by alternative. However, since Alternative 1 would involve development in predominately rural areas at the most rapid rate, it would probably have the greatest impacts.

Energy Efficiency

Alternatives 1 and 2 have the lowest rates of energy efficiency (percent energy output to resources input). Alternative 5, although not quantified, would have the highest energy efficiency because it would employ essentially renewable natural resources and energy sources and energy conservation techniques which would reduce wasteful energy consumption. Alternative 4 would have the next best energy efficiency rating.

Alternatives 1 through 4 would involve the combustion of coal for producing electricity, resulting in the consumption of this fossil fuel. Consumption of coal would be highest under Alternatives 1 and 2, and lowest under Alternatives 3 and 4. This coal is nonrenewable and would be unavailable for future use. Alternative 5 would employ essentially renewable energy sources (sun, wind, biomass).

Alternative 6 would involve the continued consumption of oil. This fossil fuel is in decreasing supply and is nonrenewable. Because of its scarcity, it is subject to erratic price fluctuation, making it an unstable fuel source to produce electrical energy, resulting in unstable energy costs to consumers.

IDENTIFICATION OF THE BUREAU OF LAND MANAGEMENT PREFERRED ALTERNATIVE

The BLM preferred alternative is the development of the Harry Allen powerplant and associated transmission lines at a capacity meeting State and Federal regulatory requirements, in combination with energy conservation and

alternative energy resources. The preferred alternative does not include development of the proposed Warner Valley powerplant, associated transmission lines and proposed coal slurry pipeline, or the proposed Warner Valley water project as currently designed. The BLM preferred alternative would defer the decision on the Alton well field and the coal slurry pipeline associated with the Harry Allen powerplant until the Secretary of the Interior's decision on the Alton coal field unsuitability petition and until the Utah State Engineer decides on the proponents' water right applications.

This selection is consistent with the assumption and analysis guidelines in the EIS (Chapter 4), that any one or parts of the proposed action and/or the alternatives can be selected as the preferred alternative. Each component of the agency preferred alternative is analyzed in depth in Chapter 4 of this EIS. These analyses are summarized in the preceding section.

This BLM preferred alternative would contribute to meeting the following three important national goals: (1) reducing our nation's dependence on oil consumption, partially through increased use of coal, (2) supplying 20 percent of our nation's energy needs in the year 2000 through energy conservation and renewable sources, and (3) protecting our human environment. The preferred alternative is not the decision on the project, only BLM's preference based on the information in the EIS, including the numerous comments and views expressed by the applicants, other agencies, organizations, and the public. BLM has considered the current positions of State and Federal regulatory agencies with various authorizing actions related to the proposed project. Final decisions by these agencies and the applicants will affect or determine the final configuration of the AWW energy system. These decisions include: the Secretary of the Interior's decision on the Alton unsuitability petition; CPUC's decision on a Certificate of Public Convenience and Necessity; the EPA PSD permit decision for the Harry Allen powerplant; the Utah State Engineer's decision on water rights for the coal slurry pipeline; and the approval of an acceptable mine plan for the Alton coal lease area by the Office of Surface Mining Reclamation and Enforcement.

The preferred alternative includes:

1. Authorize Use of Public Land for the Harry Allen Powerplant and Related Facilities. It appears that the applicant, in response to decisions by the State and Federal agencies, should be able to obtain the permits necessary for development of a powerplant of a size yet to be determined at the proposed Harry Allen site. The generating capacity (and thus, size of the site approved by BLM) would be determined by decisions to be made by EPA, the State of Nevada, and CPUC, concerning air quality control technology, source of coal, and participation in the powerplant. Use of public land for the powerplant and related facilities would result in a reduction in the amount of oil used to generate electricity for consumption in California, and offer the prospect of socioeconomic benefits to industrial, commercial, and residential electric power users in California and Nevada.

2. Support and Encourage Energy Conservation Plans and Nonconventional Energy Sources Developed by the Participants and the Respective State Regulatory Agencies. In selecting the preferred alternative, BLM endorses steps taken by the State of California and project participants to stimulate energy conservation and the use of alternative energy sources in California. As

discussed in the EIS, conservation and nonconventional energy sources would be economically and technically feasible within the time period in which SCE and PG&E must plan to meet new energy demands, and could further reduce the amount of oil used to generate electricity in their service areas. Similar conservation efforts in Nevada and Utah could be pursued.

3. Grant the Rights-of-Way and Other Land Use Authorizations for Transmission Lines Needed to Transmit Power from the Harry Allen Powerplant to the Las Vegas Area and Southern California. The preferred southern California transmission route is the I-15 corridor. Size and capacity of the transmission lines in the corridor would be adjusted to match the output capacity of an EPA and State of Nevada approved powerplant at the Harry Allen site. Final routing and configuration of the transmission lines within the corridor would be accomplished in cooperation with the applicants, local and State authorities, and BLM after on-ground surveys would be completed. As identified in the EIS, any significant impacts could be mitigated through stipulations in the grant. However, there would be land use conflicts in the corridors that would pass through the Rainbow Gardens area near Henderson, Nevada and in the McCullough Pass area in southern Nevada. These possible conflicts would have to be resolved.

4. Take "No Action" with Respect to Granting Rights-of-Way Associated With the Proposed 500-MW Warner Valley Powerplant Site. This action is in accordance with EPA's notice of intent to disapprove the NPC PSD permit application because available information fails to demonstrate that air quality standards at Zion National Park can be attained. At this time, the applicant has declined to submit further data which could affect the decision.

The absence of the Warner Valley powerplant from the agency preferred alternative includes "No Action" on the coal slurry pipeline and transmission lines associated with the Warner Valley powerplant.

Adoption of "No Action" on the proposed Warner Valley powerplant is not based on BLM's determination of the need or lack of need for the facility. The elimination of the 500-MW unit from the project would result in the project's total capacity falling short of the projected combined participation of the California, Nevada, and Utah utilities. However, according to a determination made by the CPUC staff, the California utilities' use of load management, conservation, and alternative generating technologies (largely from renewable resources within California) combined with their other generating facilities, would assure that the elimination of the Warner Valley project would not cause power shortages in California.

The elimination of the 500-MW Warner Valley powerplant would decrease the total potential of the project to lower the consumption of oil in California, and would cause the city of St. George to seek other methods to meet projected energy demands (i.e., construction of transmission lines to obtain power from existing sources).

5. Consider a Revised Application for a Right-of-Way and Other Land Use Authorizations to the Washington County Water Conservancy District for Warner Valley Water Project. The water project as proposed is designed to serve the Warner Valley powerplant as well as the other needs projected by the Washington County Water Conservancy District. Without the Warner Valley

powerplant requirements, a redesigned project would be able to serve the future water needs of the County, and could be designed so that it would not jeopardize the endangered woundfin minnow and dwarf bearclaw poppy. Revision of the current application would not pose any near-term water supply problems for the Washington County Water Conservancy District, which has existing projects capable of meeting short-term water needs. An amended application should redefine the size, operation, and extent of the land required for a revised project.

6. Defer Action on the Use of Public Land for the Alton Well Field and the Coal Slurry Pipeline Associated With the Harry Allen Powerplant. BLM would defer action on rights-of-way applications for the proposed Alton well field and coal slurry pipeline associated with the Harry Allen powerplant until after the Secretary of the Interior's Alton coal field unsuitability petition decision, and until the Utah State Engineer renders a decision on the water rights application. If the Secretary finds that these lands are "suitable" and if the State Engineer acts favorably on the water rights application, then the well field and slurry pipeline applications would be approved at an appropriate capacity and configuration. If the Secretary finds the land "unsuitable" for surface mining, and if the State Engineer disapproves the water rights application, then the well field and slurry pipeline applications would not be approved.

CHAPTER 3

AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the environment of the areas that would be affected through the implementation of any one or parts of the alternatives described in Chapter 2. Impacts to the environmental elements immediately following were not found to be of sufficient significance to be analyzed in detail. Thus, the affected environment is described only briefly for these elements. Those environmental elements which would sustain more significant impacts, as determined during the scoping process (Chapter 1), are described later in the chapter.

ENVIRONMENTAL ELEMENTS WITH MINOR IMPACTS

Climate

The climate of the affected environment ranges from the lower elevation hot desert of the Mojave Desert (southern California, southern Nevada and southwestern Utah), to the upper elevation cold deserts (central Utah and southwestern Wyoming) and is interspersed with mountain climates. Precipitation in the area is influenced greatly by storms out of the Pacific Ocean in the winter and early spring and by Gulf of Mexico storms in the late spring and summer. The desert regions receive the least amount of moisture (2 to 6 inches per year at Las Vegas) and the mountain regions receive the most (12 inches or greater per year). Areas west of the Sierra Nevada Mountains receive substantially more moisture due to coastal influence (e.g., over 21 inches at Lugo, California in 1977-78).

Prevailing wind directions vary from south-southwest in Nevada and Utah to west-southwest in Wyoming.

Topography and Geology

The topography and geology are characterized by several isolated mountain ranges separated by depositional valleys and basins in southern California and southwestern Utah. The topography of central Utah is characterized by steep, dissected plateaus and canyonlands of the Wasatch Plateau. Low mountains and semiarid basins characterize the region of southwestern Wyoming.

Seismic risk is major in southern California, moderate in southern Nevada and southwestern and central Utah, and minor in southwestern Wyoming.

Paleontological Resources

Vertebrate and plant fossil-bearing rocks occur throughout the affected environment. No site-specific inventories have been performed in the affected regions except for a sampling inventory along the alternative corridors of the proposed Western Transmission System. According to Reynolds (1979), 52.8 miles of the 777 miles in the Western Transmission System are considered high in paleontological value.

Minerals Development

The U.S. Geological Survey, under a very general classification system, considers Warner Valley, Utah and Dry Lake Valley, Nevada as prospectively valuable areas for oil and gas resources (Pera et al., 1976). The Dry Lake site for the proposed Harry Allen powerplant is almost completely blanketed with leases for oil and gas. Seismic exploration has taken place, but there has been no actual drilling.

The Springdale Sandstone member of the Moenave Formation outcrops intermittently in Warner Valley. The sandstone is a known producer of silver, copper, and uranium. Numerous mining claims have been staked and one State lease has been issued in the valley, but little exploration has taken place. Approximately 2,000 mining claims have been staked for uranium on the Chinle Formation in Warner Valley since the 1950s. At present there is no active exploration of these claim sites (Bureau of Land Management [BLM], Cedar City District Office Files, 1979). No other minerals of economic value would be affected in the region covered by this environmental impact statement (EIS).

Soils

Soils in the affected environment consist primarily of alluvial valley soils, shallow rocky soils, badlands, and rocklands in southwestern Wyoming, central Utah, and in the Alton coal lease area. Soils occurring in the arid environment of the Mojave Desert from southwestern Utah through southern Nevada to southern California consist of sands, silts, gravels, badlands, and rocklands. Because of the rigorous climate, the soil vegetation ecosystem is very delicate. Water-related erosion rates vary with precipitation. Natural annual sediment yields in southwestern Wyoming are about 5 tons per acre (Development of Coal Resources in Southwestern Wyoming Environmental Statement [SW], USDI, BLM, 1978); in central Utah they are from 2.4 to 3 tons per acre (Development of Coal Resources in Central Utah, Environmental Statement [CU] USDI USGS, 1979); 0.6 to 3 tons per acre in the Alton area (CU USDI, USGS, 1979); and 0.6 to 1.5 tons per acre in the Mojave Desert region ([U.S. Department of Agriculture], 1975). Wind erosion is moderate to high in these areas (especially where vegetation cover is sparse or lacking), but there is insufficient data to quantify the actual rates.

Vegetation: General

The most common vegetation types of central Utah are the aspen-conifer and the pinyon-juniper associations.

Pinyon-juniper and sagebrush associations are the principal types encountered in the Alton area.

Four vegetation types commonly occur in the southwestern Wyoming mining region: sagebrush, saltbush, greasewood, and juniper.

The common Mojave Desert vegetation types are found in Warner Valley in southwestern Utah, across southern Nevada, and in southern California. They consist of: blackbrush, creosote bush, various understory grasses, Joshua trees, and pinyon-juniper trees.

Wildlife: General

Big game animals encountered in the central Utah coal mining region include: numerous mule deer, three herds of elk, some transplanted herds of antelope, mountain lion, and black bear. Various species of small mammals occur throughout the region, including: muskrat, mink, rabbits, foxes, coyotes, etc. Also found are various nongame birds, raptors, reptiles, rodents, and fishes.

Antelope are the most prevalent big game species inhabiting the southwestern Wyoming coal region. Mule deer, elk, and moose are also present. Various nongame birds, raptors, small mammals, reptiles, and rodents are habitants of the coal producing region. An increasing population of wild horses is also present.

Game animals occurring in the area of Alton, Utah include mule deer, rabbit, mountain lion, sage grouse, wild turkey, coyote, bobcat, badger, various small mammals, raptors, nongame birds, reptiles, and rodents.

The Mojave Desert region extends from southwestern Utah, across southern Nevada, and into southern California. It is habitat for principally small nocturnal mammals. Predators such as bobcat, kit fox, and coyotes are also common. Various nongame birds and raptors occupy the region primarily in the winter months. The desert region is also habitat for many common species of amphibians and reptiles, including the desert iguana, desert horned lizard, gopher snake, red racer, sidewinder, and the Mojave rattlesnake.

ENVIRONMENTAL ELEMENTS WITH MAJOR IMPACTS

Air Quality

Existing Air Quality

Most of the affected environment has been designated Class II under the Prevention of Significant Deterioration (PSD) Regulations. This means that air quality deterioration that accompanies moderate, well-controlled growth would not be considered significant. Three mandatory PSD Class I areas (areas where nearly any air quality deterioration would be considered significant) are in close proximity to the project areas: Zion, Bryce Canyon, and Capitol Reef National Parks. The Paiute Primitive Area (northwestern Arizona) and Cedar Breaks National Monument have been recommended by the Secretary of the Interior for Class I air quality designation (fig. 3-1). The State of Nevada had requested that any analysis consider the Valley of Fire State Park as a potential Class I area (personal communication, Mike Nolan, Governor's Office of Planning Coordination, State of Nevada, January 31, 1980). Therefore the draft EIS considered the Valley of Fire State Park as a potential Class I area. However, the State of Nevada has since requested BLM to treat the Valley of Fire State Park as a Class II area in the final EIS (personal communication, Mike Nolan, Governor's Office of Planning Coordination, State of Nevada, October 3, 1980), and therefore it is treated as Class II in this document.

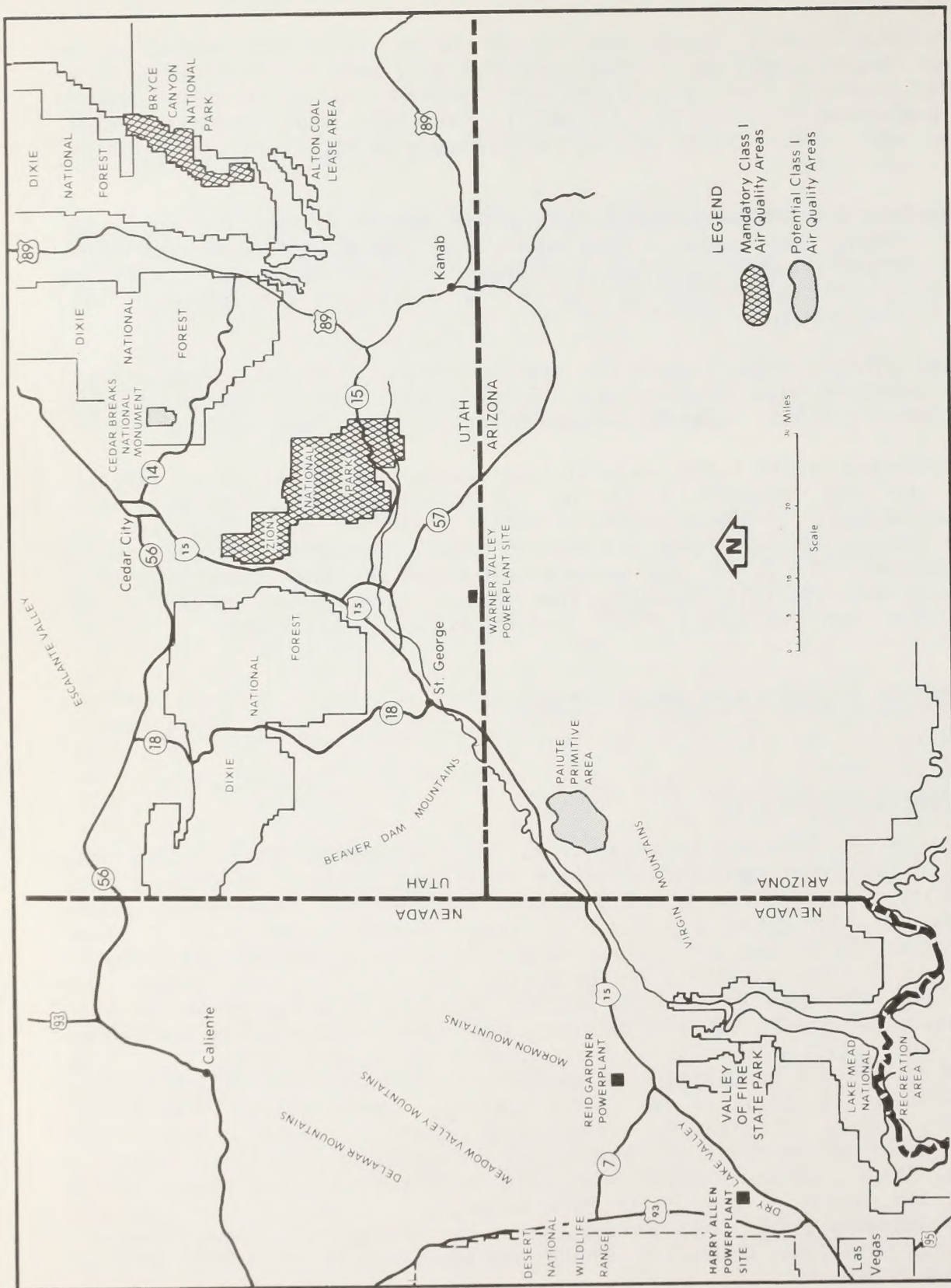


FIGURE 3-1
MANDATORY AND POTENTIAL CLASS 1 AIR QUALITY AREAS

The Las Vegas Air Quality Maintenance Area (AQMA) has been classified as a "nonattainment" area for particulate matter, carbon monoxide, and ozone because of urban and industrial growth. The area between Baker and Lugo, California has been classified "nonattainment" for particulate matter because of long-range transport of particulates from southern California and wind-blown dust (SW, USDI, BLM, 1978); (CU, USDI, USGS, 1979); (Development of Coal Resources in Southern Utah Environmental Statement [SU], USDI, USGS, 1979); (Nevada Power Company, [NPC], 1975; Southern California Edison Company [SCE] and Pacific Gas and Electric Company [PG&E], 1979). No significant increase in these air pollutants can be caused by a new or existing source (industrial or electricity generating) in a "nonattainment" area.

Ambient sulfur dioxide (SO_2) measurements in the affected area show no violations of the primary or secondary National Ambient Air Quality Standards (NAAQS) or applicable State regulations. In general, SO_2 concentrations are low because there is not a high concentration of fossil-fuel-powered industrial sources in the area.

Nitrogen dioxide (NO_2) concentrations are well below the primary NAAQS and applicable State regulations. This, too, can be attributed to the lack of any high concentration of combustion sources in the affected area. However, under certain meteorological conditions NO_2 emissions from powerplants have been known to cause a yellow discoloration of the atmosphere at the Emery, Huntington, Jim Bridger, Naughton, and Reid Gardner powerplants in the EIS area.

Very few ozone (O_3) concentration measurements have been made in the affected environment. The highest measured hourly O_3 concentrations in the rural areas are generally a result of thunderstorms. The majority of measured concentrations are well below the NAAQS for ozone. However, the Las Vegas AQMA and the area from Baker to Lugo, California are nonattainment areas for ozone. The Las Vegas ozone problem is probably due to automobile and petroleum related sources (Clark County Department of Comprehensive Planning, 1978). The Baker to Lugo problem is probably due to long-range transport of ozone from southern California (SCE and PG&E, 1979).

Only limited visibility measurements exist for the affected environment. From airport visibility data, modern visibilities in the nonurban areas of southwestern United States are approximately 65 to 80 miles (SU, 1979). Measurements at Cedar Mountain, Utah, using photographic photometers have shown visibility ranges from 54 to 94 miles (SU, 1979). Visibility measurements in Warner Valley with an integrating nephelometer during 1977 and 1978 showed mean visual ranges of 80 miles and 76 miles, respectively (Stearns-Roger, 1978). However, wind blown dust due to very strong winds can cause as much as 70-percent reduction in visual range on winter mornings and late afternoons and as much as 90-percent reduction on summer mornings (Cramer et al., 1978). The NPS is presently monitoring visual range at Bryce and Yovimpa Points in Bryce Canyon National Park and at Lava Point in Zion National Park. Additional visibility studies by both the National Park Service (NPS) and NPC are currently in process and should yield better information.

In accordance with the Clean Air Act as amended, 1977, Capitol Reef, Bryce Canyon, and Zion National Parks have been identified as areas where

visibility is an important value. The present policy of the NPS is to protect these areas from any adverse impairment at human levels of perception. Regulations regarding visibility in Class I areas are scheduled for completion in November 1980. The NPS is currently identifying integral vistas related to Class I areas (as defined in the proposed visibility regulations). Final determination of integral vistas is expected soon after promulgation of the regulations.

Predominant wind directions which affect ambient air quality in the region vary from the south-southwest in Nevada and Utah to west-southwest in Wyoming (SU, 1979; SW, 1978; NPC, 1975).

Background Trace Elements

Several measurements of the concentration of trace elements in the ambient air were made near the proposed Warner Valley plant site. In addition, the Environmental Protection Agency (EPA) has sampled trace elements at Bloomington, Utah about 12 miles west of the proposed site, and near Pipe Spring National Monument, Arizona, about 25 miles east of the proposed site. The observed background levels of the atmosphere are summarized in table 3-1.

With the exception of manganese concentrations, the background levels for trace elements in the atmosphere are comparable to other measurements made in rural locations in the southwest. However, these measurements must be interpreted with care since they are based on a very limited number of samples.

Warner Valley trace element concentrations in the other environmental components (i.e., soil, water, etc.) are thought to be high, based on water quality studies in the Virgin River, geological information, and preliminary soil, plant, and animal analyses.

Preliminary water quality data obtained by Vaughn Hansen Associates (208 Water Quality Study, 1977) on the Virgin River indicates trace element concentrations of selenium, arsenic, and radioactive elements in excess of recommended irrigation water standards below Hurricane, Utah (Utah Water Research Laboratory, 1974). In addition, drinking water standards are commonly exceeded for selenium and possibly lead. This data is indicative of high trace element concentrations somewhere within the Virgin River drainage. Preliminary data from the applicants (NPC, 1975) indicates that there are toxic levels of selenium in vegetation within the proposed plant site. However, selenium poisoning of livestock has not been reported in Warner Valley.

Water Resources

Water resources in the affected environment are described below for the southwestern Wyoming coal fields, central Utah coal fields, Alton coal lease area, Virgin River system below the Hurricane diversion, and at the proposed powerplant site at Dry Lake, Nevada. Water resources of the coal fields are discussed in detail in the respective environmental impact statements (Scope of EIS, Chapter 1).

TABLE 3-1

State and Federal Air Quality Standards and Regulations

	Sulfur Dioxide			Nitrogen Dioxide (NO ₂)	Suspended Particulate Matter	
	Annual	24-Hour	3-Hour	Annual	Annual	24-Hour
(micrograms per cubic meter [µg/m³])						
NATIONAL AMBIENT AIR QUALITY STANDARDS						
Primary ^a	80	365	.....	100	75	260
Secondary ^b	...	...	1,300	Same as Primary	60	150
Wyoming	60	260	1,300	100	60	150
SIGNIFICANT DETERIORATION						
Class I	2	5	25	NA	5	10
Class II	20	91	512	NA	19	37
Class III	40	182	700	NA	37	75
NEW SOURCE PERFORMANCE STANDARDS						
1.2 lb SO ₂ /10 ⁶ Btu heat input and 90-percent scrubber efficiency, except 70 percent control when emissions are less than 0.6 lb SO ₂ /10 ⁶ Btu heat input.			If subbituminous coal; 0.5 lb NO ₂ /10 ⁶ Btu heat input. If bituminous coal: 0.6 lb NO ₂ /10 ⁶ Btu heat input.		0.03 lb particulate matter/10 ⁶ Btu heat input.	

Source: Coal Fired Power Plant Trace Element Study, EPA, 1975

^aFor the protection of human health.

^bFor the protection of human welfare (aesthetics, plants, etc.).

NOTE: At present, the Utah and Nevada State air quality regulations are the same as the Federal regulations.

The Surface Mining Control Act of 1977 (PL 95-87) provides guidelines designed to protect alluvial valley floors in coal mining regions. Office of Surface Mining, in conjunction with BLM, will delineate the alluvial valley floors in the Alton area during investigations in the unsuitability determination for the Alton coal lease area. The present status of alluvial valley floor determination is discussed in detail in Southern Utah Petition Evaluation Document (SUPED, 1980).

Central Utah

The central Utah coal fields are generally drained by tributaries to the Green and Colorado Rivers. Principal tributaries are the Price and San Rafael Rivers and Muddy Creek. A small portion of the western part of the region is drained by Salina Creek, which flows into the Sevier River. Stream flows in the region are essentially ephemeral in nature, although the major tributaries generally flow year round. The flows of all major rivers and tributaries in the region are affected by irrigation diversions, often transferring the water into adjacent basins (CU, 1979).

Surface water quality is relatively good in the headwater areas but deteriorates downstream (from 100 to 500 milligrams per litre [mg/l] of total dissolved solids [TDS] in the upper reaches to 1,000 to 5,000 mg/l of TDS downstream). Concentrations of several metals exceed recommended drinking water standards in the middle and lower reaches of Muddy Creek and the Price, Green, and San Rafael Rivers. These concentrations may be due to a combination of man-made and natural (geologic) contamination. Surface water is primarily utilized for irrigation in the region (80 to 90 percent). Other uses include municipal and industrial applications. One significant water use in the region is for present and projected coal-fired electric powerplants. Water use could reach about 62,000 acre-feet annually when in full production (CU, 1979).

The principal ground water aquifer in the region is the unconsolidated alluvium surrounding the major streams. Wells in these aquifers yield 50 to 500 gallons per minute (gpm) of water with less than 1,000 mg/l of TDS. Wells that tap consolidated (rock) aquifers prevalent throughout the region usually yield less than 50 gpm of poorer quality water (500 to 3,000 mg/l of TDS). Although the total amount of ground water used in the region is small, it is the principal source of water for several small communities (approximately 10,000 acre-feet per year). Other uses include stock and wildlife consumption and some irrigation applications.

Southwestern Wyoming

The southwestern Wyoming coal fields lie on the flanks of the Great Divide Basin and are primarily drained by ephemeral tributaries of the Green River. The extreme western part of the region is drained by Twin Creek, which flows into the Great Basin (an area of interior drainage). Surface water quality in the region is generally good, however TDS concentrations tend to increase downstream from the headwaters, due to both natural and man-made sources (SW, 1978). TDS concentrations in the Green River near Green River, Wyoming normally range from 300 to 600 mg/l.

Ground water conditions in this region are primarily controlled by the complex geology underlying the area. Well yields range from 1 to 500 gpm, but generally average between 10 to 100 gpm. Ground water quality varies considerably over the region due to geologic conditions and depth, but aquifers yielding water with less than 3,500 mg/l of TDS underlie most of the region. Ground water use in the region is small, generally limited to stock watering. Other minor uses include domestic and industrial supplies (including some oil and coal mining operations).

Ground Waters in the Vicinity of the Alton Coal Lease Area

Shallow ground water aquifers in the vicinity of the Alton coal lease area include the Quaternary alluvium, and the Dakota and Entrada Sandstones. Little data is available on the ground water occurring in and near the lease area. Information compiled by Sandberg (1979) indicates that surface and shallow ground waters are closely related and that net water level reductions in irrigation wells may be due to reduced surface flow (and subsequent and reduced ground water recharge) of the adjacent streams.

The primary deep aquifer that would be affected by slurry water pumping would be the Navajo Sandstone. This formation outcrops south of the coal lease area and dips northward beneath the relatively impermeable Carmel Formation. The coal-bearing Dakota Sandstone (proposed to be mined) overlies the Carmel Formation. The Navajo Sandstone is a medium grained quartz sandstone characterized by poor cementation and relatively high porosity and permeability. These latter characteristics may be locally enhanced by fracturing and jointing. Structurally, the Navajo is composed of two members - a thick upper member (up to 1,800 feet thick) separated from a lower member, the Lamb Point Tongue, by the Tenny Canyon Tongue of the Kayenta Formation. The Tenny Canyon may restrict vertical movement of water in places. Recharge to the Navajo primarily occurs from precipitation in the outcrop area (Goode, 1980), however, some recharge may pass through the overlying Carmel Formation (Cordova, 1980).

The Navajo Sandstone has estimated storage ranging from 19,200 to 200,000 acre-feet per square mile (Goode, 1964, 1966); Bingham Engineering, 1974; Utah International, Inc., 1979). Estimated specific yields for this formation range from 0.08 to 0.04 and saturated thickness near the proposed well sites is approximately 1,100 feet. These characteristics are important in determining the amount of water available by pumping. The influence of faults as mapped by Goode (1973) is unknown, since they may not extend into the formation and since no significant pumping tests have been completed to date (fig. 3-2). Utah International, Inc. performed a limited pumping test on Bald Knoll Well Number 3 during 1978, but drawdowns were measured only in the pumped well and pumping lasted only 10 hours. Results of the test were inconclusive except that water quality from the formation was shown to be good and well yields of 270 gpm could be pumped and maintained (Utah International, Inc., 1979).

Virgin River System

The Virgin River, consisting of nearly 200 river miles in Utah, Arizona, and Nevada, is part of the Colorado River Basin. The headwaters are located in the Markagunt Plateau in Utah at elevations of 9,000 to 10,000 feet. The

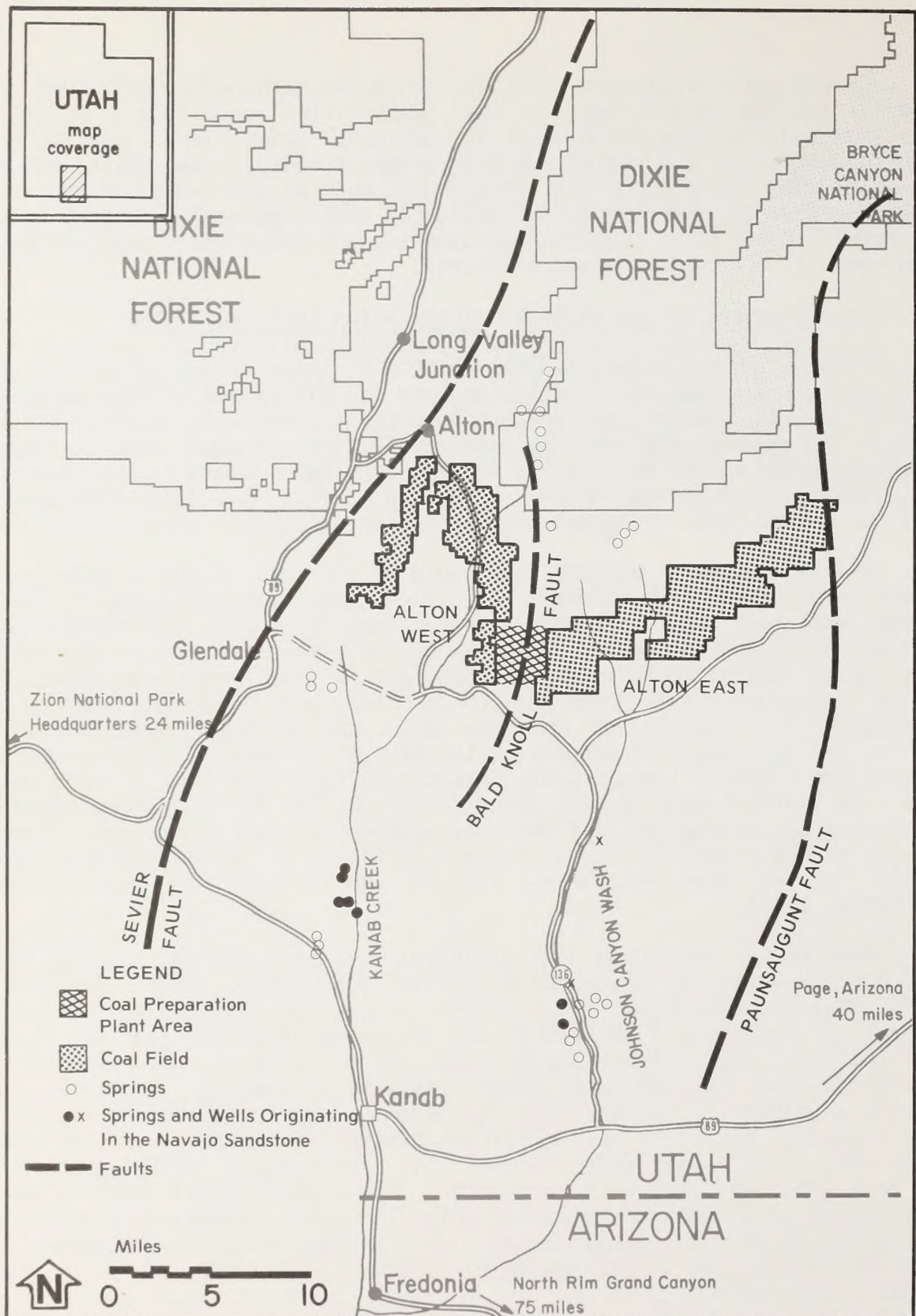


FIGURE 3-2

SPRINGS AND WELLS IN THE VICINITY OF THE ALTON COAL LEASE AREA

headwater tributaries and the North and East Forks of the Virgin River merge near the west entrance of Zion National Park. Downstream the river passes near the cities of Virgin, Hurricane, St. George, and Bloomington, Utah; Littlefield, Arizona; Mesquite, Bunkerville, and Riverside, Nevada; and finally empties into Lake Mead (fig. 3-3).

River flows are highly variable. The climate and terrain in the Virgin River Basin typically create extremely low flows during the summer months. The greatest monthly flows occur in the spring as a result of snowmelt at the higher elevations. These high flows dominate the channel morphology, generally flushing out sediments that accumulate during the low flow periods. The average flows from 1945 to 1971 at the Virgin, Utah gaging station ranged from a high of 357 cubic feet per second (ft^3/s) in May to a low of 99 ft^3/s in July (Water Resources Data, USDI, USGS, 1945-1971).

River flow has been greatly modified by numerous irrigation diversions between the town of Virgin and Lake Mead. In normal years the entire flow in the river is diverted during the summer months. Late summer diversions usually empty the river channel above St. George, Utah.

High sediment concentrations present major water quality problems on the river. The high production of sediment is caused by natural geologic and climatic conditions and, to a lesser extent, poor land use practices. Sudden increases in flow caused by intense thunderstorms generally create the greatest suspended sediment concentrations. Suspended sediment measurements taken at the Virgin gaging station by USGS over a 10-year period show that concentrations can vary from 125 to 268,000 mg/ℓ . Under average flow conditions at the Virgin gaging station (100 to 200 ft^3/s), sediment concentrations generally are under 5,000 and are often under 500 mg/ℓ . However, when flows exceed 500 ft^3/s , sediment concentrations are often over 100,000 mg/ℓ (Utah Water Research Laboratory, 1974). Because of high sediment concentrations, high flows are generally bypassed at the irrigation diversions along the river.

High TDS concentrations are also characteristic of the Virgin River below Hurricane, Utah. Mean annual TDS concentrations increase progressively down the river, from an annual average of less than 500 mg/ℓ at Virgin, Utah to greater than 2,000 mg/ℓ at Bloomington, Utah (USDI, Bureau of Reclamation, 1974). The increase in salinity is caused by inflow of saline springs and ground waters, and by irrigation return flows.

The affected environment includes the Virgin River from Virgin, Utah, to Lake Mead, Nevada (fig. 3-3). Average annual flow at the Virgin gaging station for water years 1940 through 1971 was about 124,000 acre-feet (fig. 3-4). About 1 mile downstream, the existing Hurricane diversion dam transfers an estimated 12,600 acre-feet of water per year to the Hurricane area for irrigation. About 600 acre-feet per year are lost in transfer, making the total annual diversion about 13,200 acre-feet (Bingham Engineering, 1977). Water rights for this diversion total 33 ft^3/s . Irrigation water not consumed from the Hurricane Fields returns to the Virgin River via ground water systems and Gould Wash.

The LaVerkin Diversion is less than 1 mile downstream from the Hurricane Diversion (fig. 3-4). Water was originally diverted entirely for irrigation

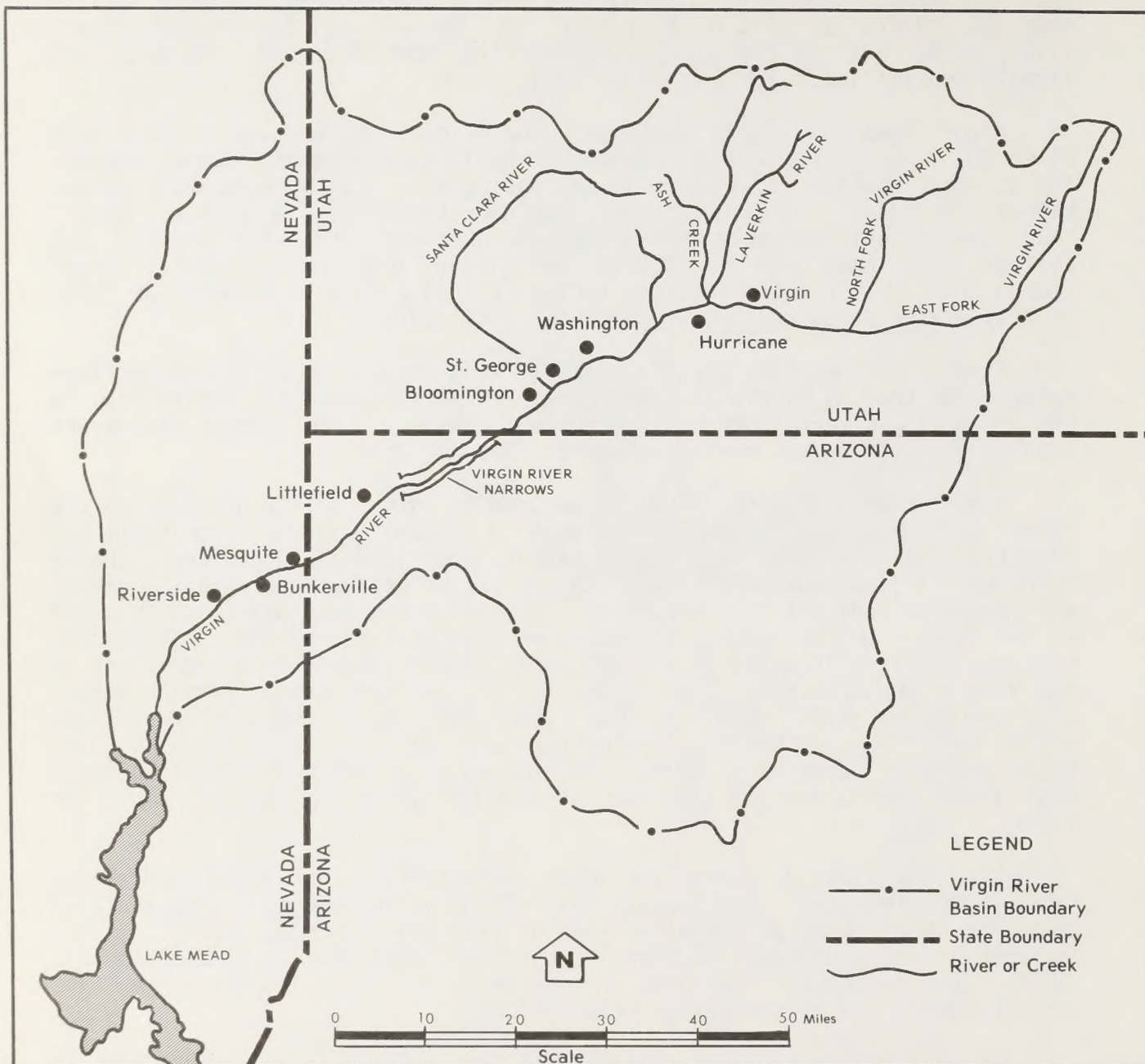


FIGURE 3-3
VIRGIN RIVER BASIN

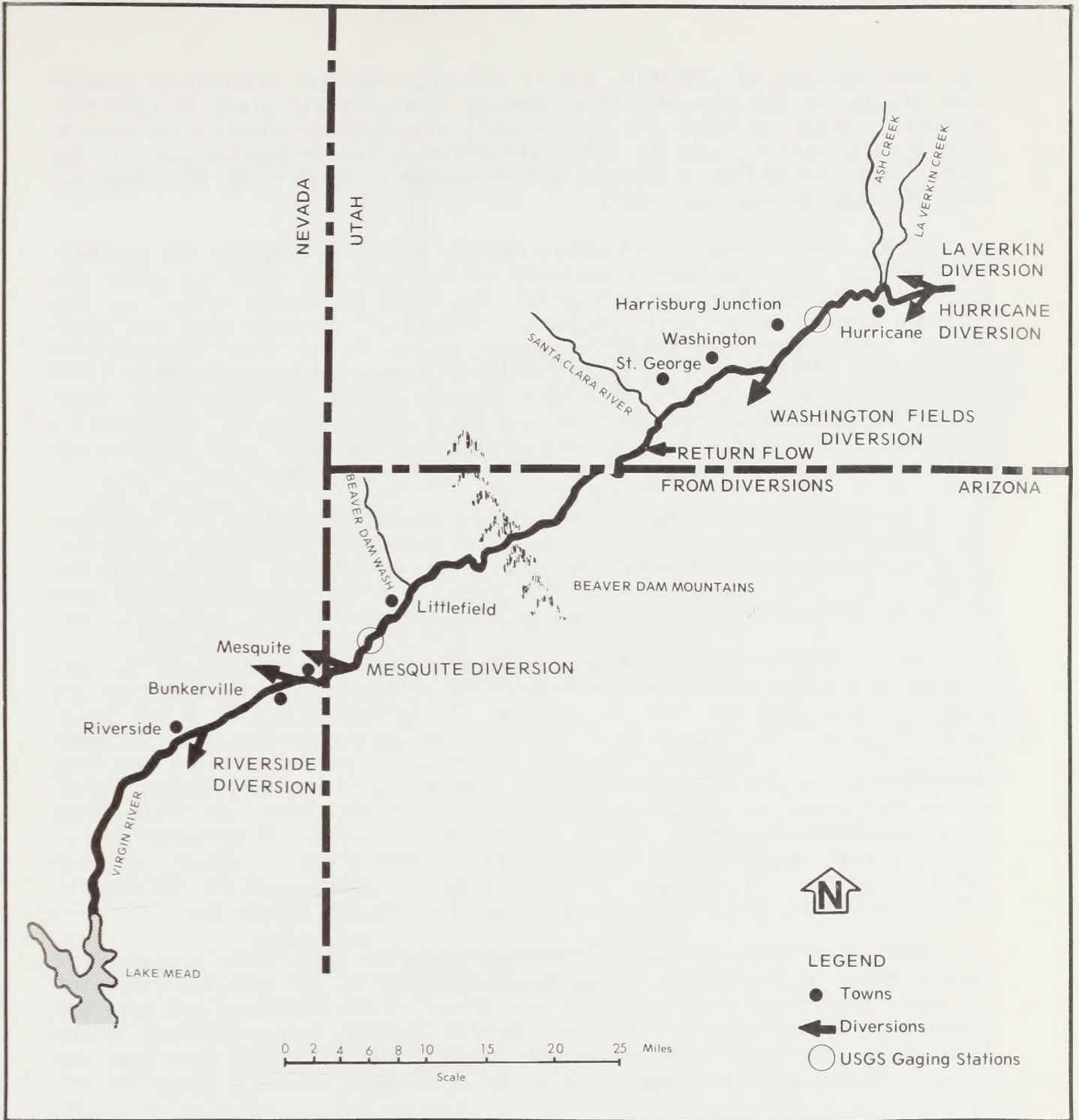


FIGURE 3-4
MAJOR DIVERSIONS OF THE VIRGIN RIVER

use near the city of LaVerkin, but is now also used for electricity generation at the CP National Utilities Company hydroelectric plant in LaVerkin. Currently, about 40 ft³/s are continuously diverted for electricity generation by the utility, and 10 ft³/s are diverted for irrigation part of the year. Total irrigation diversions are estimated to total 4,000 acre-feet per year (Bingham Engineering, 1977).

CP National, formerly California Pacific Utilities Company, has contested the Utah State Engineer's decision of February 26, 1976, to grant the Washington County Conservancy District the right to divert waters for the proposed Warner Valley water project. CP National contends that the water project would reduce the potential output of its Virgin River hydroelectric facility at LaVerkin. In a decision (Civil Number 5959) by the Utah Fifth Judicial District Court in Washington County (April 29, 1980), the court found the proposed change applications to be "physically and economically feasible ... desirable beneficial uses," and that the water could be diverted under the proposed changes "without impairing vested rights".

Figure 3-5 illustrates the effects of actual irrigation diversions on the annual flow of the river. The water diverted for the powerplant is not shown because it is returned to the river downstream. Because of the LaVerkin and Hurricane diversions, the river is often dry during the summer months below the LaVerkin Diversion to the LaVerkin Springs, about 2 miles.

The LaVerkin Springs, which discharge between 10 and 12 ft³/s, are located along the river just upstream of State Highway 17. The springs are highly mineralized and have an average TDS concentration of 9,650 mg/l. Based on an average flow of 11.5 ft³/s at 9,650 mg/l, the Bureau of Reclamation, USDI (1974) estimated the salt contribution to the Virgin River from these springs is 109,000 tons per year. The spring flow also contains radioactive radium-226 in average concentrations of 37 picocuries per liter. The Water and Power Resources Service (formerly the Bureau of Reclamation) is currently experimenting with a pilot desalinization plant at LaVerkin for the LaVerkin Springs. A permanent facility might be constructed if the experiment is successful and if Congress provides funding for the project.

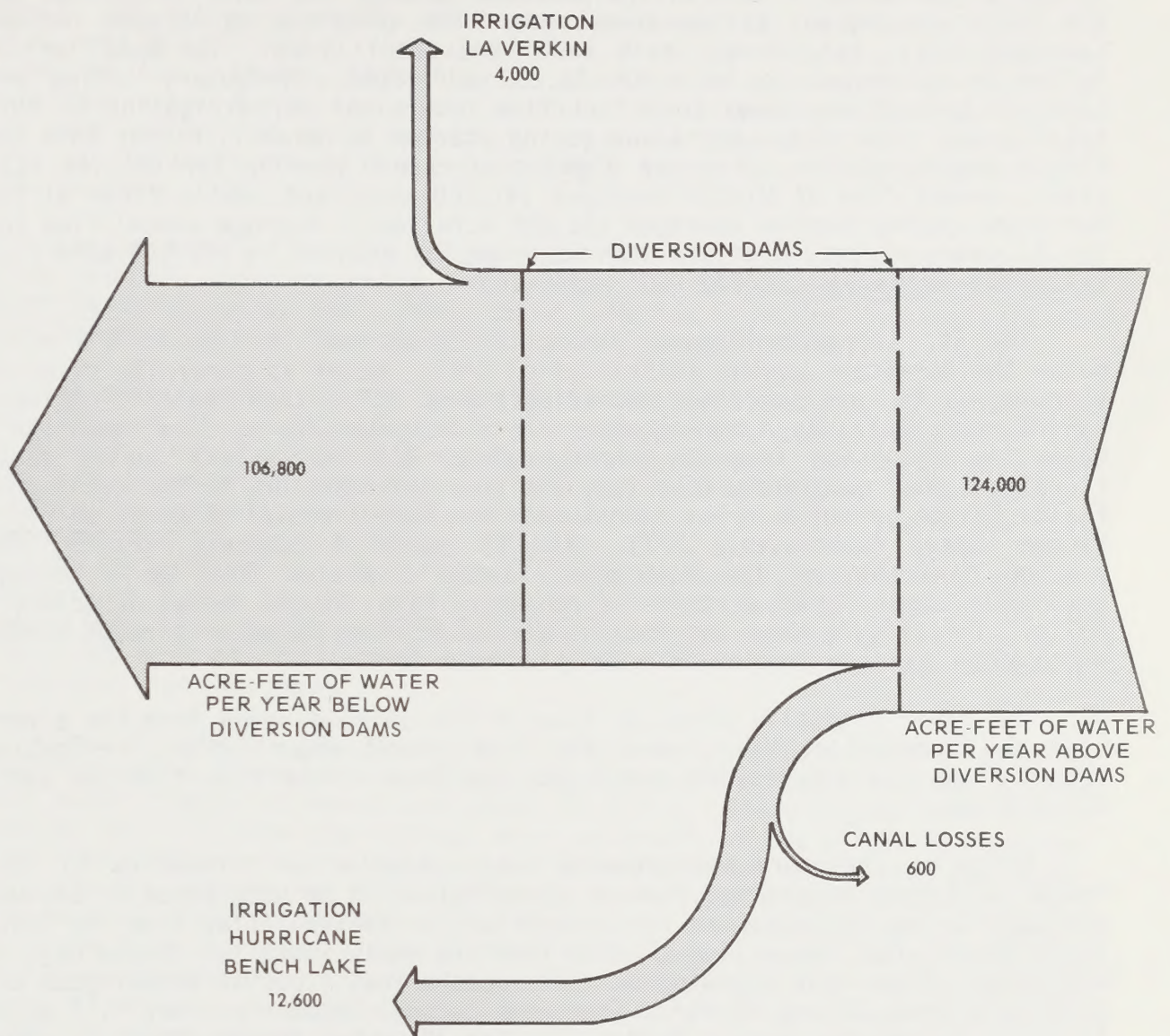
About 1 mile below the LaVerkin Springs, the hydroelectric powerplant returns water at an average of 40 ft³/s, diverted at the LaVerkin Diversion for power generation purposes. The net effect of the Hurricane and LaVerkin diversions, mineralized inflow from LaVerkin Springs, and powerplant return flow, is a lowering of the estimated annual flow to 115,000 acre-feet and increase of the average annual salinity to 1,150 mg/l.

The resulting salinity was calculated as follows:

$$\frac{\text{Undiverted Flow} \quad \text{LaVerkin Spring Flow}}{(106,800) (490 \text{ mg/l}) + (8,300) (9,650 \text{ mg/l})} = 1,150 \text{ mg/l}$$

115,100 (Combined Flow)

This compares to an average annual flow of 124,000 acre-feet and salinity of 490 mg/l at the Virgin, Utah gaging station (less than 5 miles upstream).



Source: Figures are based on computer simulation by Dr. Norman Stauffer, State of Utah, Division of Water Resources.

FIGURE 3-5
EXISTING IRRIGATION DIVERSIONS ABOVE HURRICANE, UTAH
(Acre-Feet Per Year)

Four tributaries, a few small springs, and irrigation return flow from Hurricane and LaVerkin (in addition to the powerplant return flow) add flow to the Virgin River in the 11.5-mile reach between the LaVerkin Springs and the Hurricane gaging station downstream. The contributing streams include LaVerkin Creek, Ash Creek, Gould Wash, and Quail Creek. The total annual inflow is estimated to be about 21,800 acre-feet. Tributary inflow and LaVerkin springflow appear to offset flow diversions for irrigation so that total annual flow at the Hurricane gaging station is normally higher than the Virgin gaging station. For the 4 years of record overlap for the two stations, annual flow at Virgin averaged 147,100 acre-feet, while flows at the Hurricane gaging station averaged 162,000 acre-feet. Average annual flow for the 11 years of record at the Hurricane gaging station is 147,100 acre-feet (Water Resources Data, USDI, USGS, 1945-78).

The St. George/Washington Fields diversion dam is located 4.3 miles below the Hurricane gaging station (fig. 3-4). Water is generally diverted yearlong up to, and sometimes exceeding the 95 ft³/s total water right held by the operators. As a consequence, there is generally no flow immediately below the diversion from May through July, with exceptions during flash flooding. When completely diverted, the river is often dry to the Washington Fields Bridge, about 4 miles downstream from the diversion (Endangered Fish, Vaughn Hansen Associates, 1977). For 13 years of complete records, the average diversion at the Washington Fields diversion from April through October is about 30,800 acre-feet (Endangered Fish, Vaughn Hansen Associates, 1977). This figure does not include diversions from November through March, which might average greater than 90 ft³/s each month.

The river gradually picks up flow in the 10-mile reach from the diversion to Bloomington, Utah, resulting from ground water influx, irrigation return flows via ditches and drainages, and from stream flow from the Santa Clara River.

While no long-term measurements are available for streamflow in this reach, estimates of average flow at Bloomington can be made based on assumed consumptive use efficiencies for irrigation, estimated inflow from the Santa Clara River, and from 1 year of data from the newly installed stream gage on the Virgin River near Bloomington. It appears that flows at Bloomington are usually between 20 and 50 ft³/s from June through October and may fall below 10 ft³/s during dry years. Median flow from November through March is probably about 195 ft³/s.

From water quality samples, the TDS level in the Virgin River near Bloomington appears to average greater than 2,000 mg/ℓ. These samples ranged from 1,420 to 5,900 mg/ℓ, with highest salinities typically found during lowest flows (208 Water Quality Study, Vaughn Hansen Associates, 1977).

About 8 miles downstream from the Bloomington gaging station (4 miles upstream from crossing the Utah-Arizona border) the Virgin River loses up to 50 ft³/s to the alluvium in the stream channel (Trudeau, 1979). Consequently, there is often no surface flow from this point into Arizona during the irrigation season (summer).

The Virgin River Gorge begins about 1 mile downstream from this point. The river channel winds through the gorge for 20 miles, and eventually

emerges from the Virgin Mountains at a point 4 miles northeast of Littlefield, Arizona. In the final 2 miles before leaving the gorge, the river begins to gain flow from springs discharging from the riverbed and adjacent banks. The inflow gradually increases downstream to total about 63 to 66 ft³/s near Littlefield (Trudeau, 1979). With the exception of recession stages of flash floods, this flow is usually the only water available to downstream users during the summer months. The stream gain from springs in the lower end of the gorge appears to originate from the flows lost by the river at the upper end of the canyon (EMRIA Report No. 4, USDI, BLM et al., 1975; Trudeau, 1979).

Average annual flows for 49 years of record at the Littlefield, Arizona gaging station (located below the springs) is 161,600 acre-feet per year (Water Resources Data, USDI, USGS, 1978). Median flow at Littlefield is 200 ft³/s November through May and 115 ft³/s June through October.

The median annual TDS for 1941-1972 at Littlefield was 1,900 mg/l (EMRIA, USDI, BLM, et al., 1975). Generally, average monthly concentrations of TDS are greater than 2,300 mg/l from June through October and less than 1,900 mg/l from November through May. Salinity at Littlefield is largely determined by the inflowing springs which apparently have uniform, year-round salt concentrations of about 2,900 mg/l (EMRIA, USDI, BLM, et al., 1975). Discharging 63 to 66 ft³/s, the springs act as a buffer to maintain high concentrations of salts in the river. Based on USGS records (1969-1978), it appears that flows generally must be above 500 ft³/s for the salinity to drop below 1,000 mg/l at Littlefield. A flow greater than 500 ft³/s may not occur during dry, low-flow years.

Flows in the Virgin River below Littlefield, Arizona are altered by three irrigation diversions near Mesquite, Bunkerville, and Riverside, Nevada. Total water rights in Nevada are about 66 ft³/s. These rights were determined by the flow from the springs near the mouth of the Virgin Narrows and those near Littlefield, Arizona, and from inflow from the Beaver Dam Wash. These sources average 66 ft³/s inflow to the Virgin River (Trudeau, 1979). Consequently, river flows are often completely diverted during the summer, when flows from the upper Virgin in Utah do not pass through the gorge (Endangered Fish, Vaughn Hansen Associates, 1977). From 4 years of record, average annual diversions at Mesquite and Bunkerville (fig. 3-4) are 17,000 and 10,000 acre-feet respectively (Endangered Fish, Vaughn Hansen Associates, 1977). No measurements are available for the Riverside diversion. All water rights in Nevada are for year-round diversion. Spring flows during snowmelt are diverted to irrigated farmland to flush accumulated salts. A small amount of winter and spring flow is used for cool-season irrigation during some years (personal communication, Dee Hughes, former President of Mesquite Canal Company, January 23, 1980).

Estimates of annual or seasonal flow in the Virgin River below Riverside, Nevada are not available. Flows which pass this final diversion empty into Lake Mead, 25 miles downstream.

The Colorado River Compact of 1922 is the present agreement between Utah, Arizona, and Nevada for Colorado River system water allocation.

Dry Lake, Nevada and Las Vegas Wash

Dry Lake Valley is a closed basin draining 175 square miles of Nevada desert. A 50-year storm of 2.7 inches in a 24-hour period would add approximately 20,900 acre-feet of water to the Dry Lake playa, which is normally dry. This would amount to approximately 6.5 feet of flood water above the lowest playa elevation (NPC, 1975).

Water for the proposed Harry Allen plant would be supplied primarily by treated effluent from the Clark County Advanced Wastewater Treatment plant which is currently under construction. Presently the county and city sewage treatment plants discharge 66 million gallons per day into Las Vegas Wash, which is important in the maintenance of existing wash vegetation (personal communication, Jim Parrott, Chief, Clark County Sanitation Department, March 21, 1980).

Wetlands and Floodplains

Wetlands and floodplains are not known to exist in the Alton coal processing site or in the Warner Valley powerplant site. Quantitative information on wetlands and floodplains within the possible coal development areas of Alton, central Utah, and southwestern Wyoming is not available. Such information would be made available by the coal field operator when a mining plan is submitted to the Office of Surface Mining Reclamation and Enforcement.

Wetland and floodplain areas which would be included in the affected environment would be those located in the following areas: Kanab Creek, Virgin River, Beaver Dam Wash, Sevier River, Fort Pierce Wash, Warner Valley Wash, Toquop Wash, Meadow Valley Wash, Muddy River, Las Vegas Wash, Dry Lake playa, and the Mojave River (U.S. Department of Housing and Urban Development, 1978).

BLM has requested assistance from the Army Corps of Engineers to delineate the 100-year floodplain of Dry Lake Playa, Nevada. The U.S. Army Corps of Engineers will analyze these hazards and report them to the Secretary of the Interior before a decision is made on this project. Although the delineation has not been completed as of the printing of this EIS, the U.S. Army Corps of Engineers will analyze these hazards and report them to the Secretary of the Interior before a decision is made on this project (personal communication, Norman Arno, Chief, Engineering Division, U.S. Army Corps of Engineers, September 23, 1980).

Vegetation: Species of Concern

The States of Utah, Arizona, Nevada, and California have a number of vegetation species of concern that might inhabit the affected environment. A list of these species can be found in Appendix 7.

Townsendia aprica and Astragalus subcinereus var. basalticus (candidates for endangered status) are located in the region of the central Utah coal fields. Townsendia aprica is described as the third most critically endangered plant in Utah, with less than 100 individuals in two populations remaining of this species (fig. 3-6 located at the back of this volume; personal communication, Dr. Stanley Welsh, Professor of Plant Taxonomy, Brigham Young University, December 11, 1979).

The corridors of the proposed transmission lines and the coal slurry pipeline have not been inventoried for the occurrence of threatened or endangered species. Based on knowledge of the habitats crossed, the areas most likely to have threatened or endangered plant species present are: Spry to Alton transmission route - the area southwest of Hatch, crossing the Wasatch Formation to which several candidate species for threatened and endangered status such as Lesquerella rubicundula and Cymopterus minimus are restricted; coal slurry pipeline - the red sandy area north of Coral Pink Sand Dunes which is habitat for several reviewed threatened or endangered species such as Asclepias welshii, Erigeron religiosus, and Astragalus striatiflorus; coal slurry pipeline - the Beaver Dam Mountains which are habitat of Phacelia anelsonii and Eriogonum heermannii var. subracemosum. The slurryline route contains habitat of two officially listed endangered species, Pediocactus sileri and Arctomecon humilis in the area of Warner Valley (fig. 3-6; personal communication, Dr. Stanley Welsh, Professor of Plant Taxonomy, Brigham Young University, December 11, 1979).

Two threatened plant species (Arctomecon merriami and Placelic anelsonii) occur at Apex, Nelson, and Spirit Mountain, Nevada. Three microwave sites necessary for the transmission system are proposed for these areas and may affect these Federally listed species.

The officially endangered Siler pincushion cactus (Pediocactus sileri) occurs in Warner Valley. This species is a Dixie corridor endemic occurring mainly in Arizona but extending from Price City Hills near St. George to the Shinarump Cliffs in Utah. Another officially endangered species, Arctomecon humilis (dwarf bearclaw poppy) is located in the area between Warner Valley and St. George (fig. 3-6; personal communication, Dr. Stanley Welsh, Plant Taxonomy Professor, Brigham Young University, December 11, 1979). Several species of concern, Phacelia cephalotes and Astragalus ampullarius are located in the area of the proposed Warner Valley reservoir (Welsh et al., 1975).

Wildlife: Species of Concern

The States of Utah, Arizona, Nevada, and California have a number of wildlife species of concern that might inhabit the affected environment. A list of these species can be found in Appendix 8.

An officially endangered fish, the woundfin minnow (Plagopterus argentissimus) and the rare Virgin River roundtail chub (Gila robusta seminuda), occur in the Virgin River from LaVerkin Springs to Lake Mead (fig. 3-7).

The desert tortoise (Gopherus agassizii), listed as threatened in Utah and protected under State laws in Arizona, Nevada, and California, occurs along proposed transmission and coal slurryline routes from the western slope of the Beaver Dam Mountains in Utah and Arizona to Dry Lake, Nevada and into southern California (fig. 3-6). U.S. Fish and Wildlife Service (USFWS) has designated 22,400 acres on the Beaver Dam slope of Utah as critical habitat of the desert tortoise (Federal Register, Volume 45, Number 163).

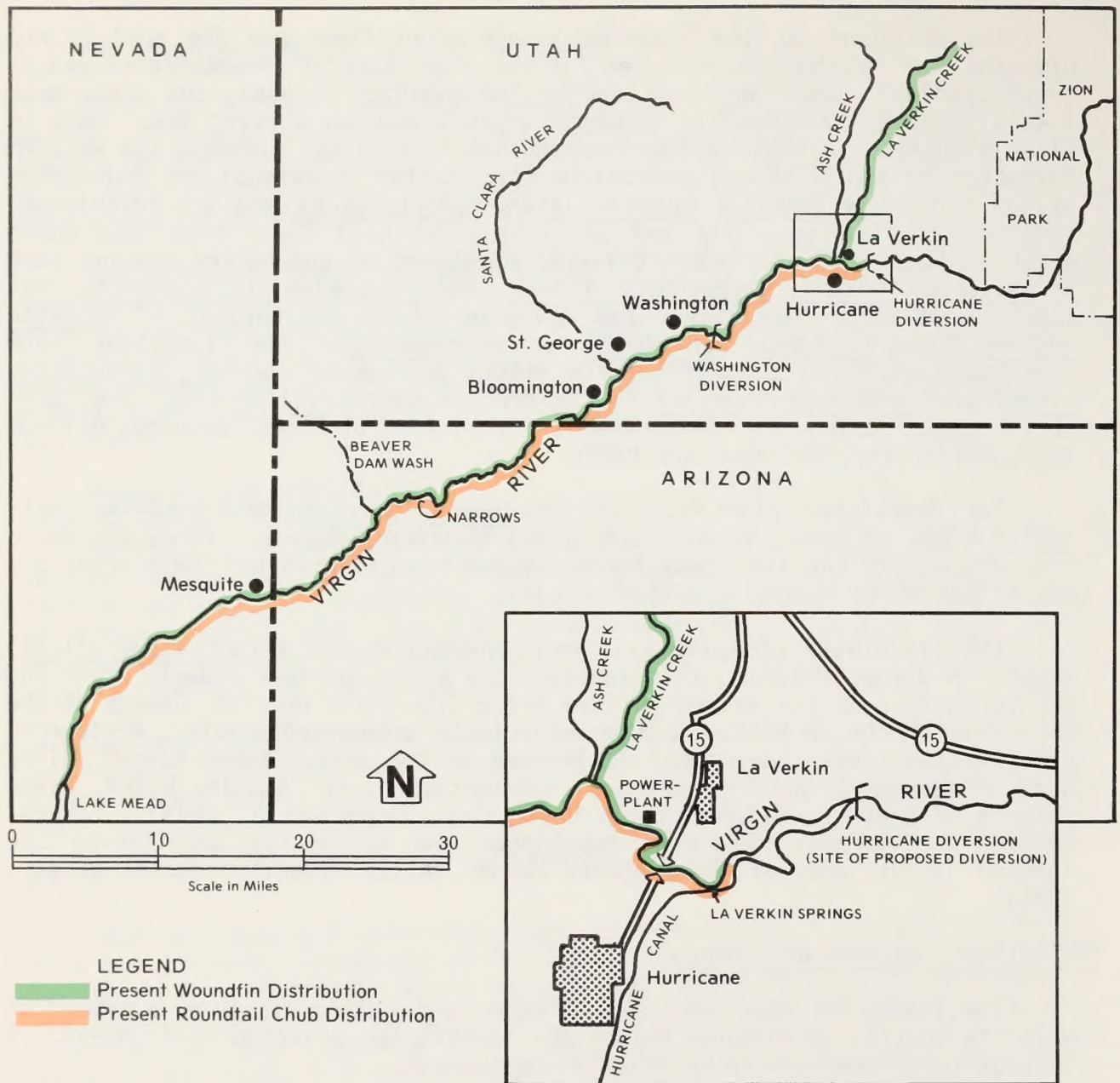


FIGURE 3-7

WOUNDFIN AND ROUNDTAIL CHUB DISTRIBUTION ALONG THE VIRGIN RIVER

Archaeology, Ethnology, and History: Cultural Resources

A review of existing data and field surveys conducted in the areas affected by the proposed project components indicates a varied cultural resource base. Two properties in the project area (Fort Pierce and the Hurricane Diversion) are on the National Register of Historic Places, and one property (Honeymoon Trail) has been nominated to the National Register. The National Register of Historic Places is a list of districts, sites, building structures, and objects significant in American history, architecture, archaeology, and culture. To be eligible for listing in the National Register a property must possess one of the following characteristics: (1) be associated with events that have made significant contributions to our history; (2) be associated with the lives of persons significant in our past; (3) yield or may be likely to yield important information on prehistory or history; or (4) embody the distinctive characteristics of a type, period, or method of construction (36 CFR, part 800). The majority of surveyed cultural resources have not been evaluated for their eligibility to the National Register. Based on prior studies conducted in the project area, it is assumed that approximately 75 percent of the unidentified resources will be of National Register caliber under the criterion that they will yield important information on prehistory.

Information presently available for this section is outlined below for the affected environment. Inventories are not yet finished for most areas, and therefore complete data is not available. Should an alternative be approved, full and complete inventories would be accomplished according to Standard Operating Procedures (Appendix 6), in accordance with the action plan for compliance with the Advisory Council of Historic Preservation procedures for the protection of historic and cultural resources (Appendix 9), and by the provisions of the "Memorandums of Understanding" developed with the State Historic Preservation Officers of the States involved in the project (Appendix 9).

A series of archaeological and historical inventories were performed in conjunction with the Development of Coal Resources in Central Utah, Final Environmental Statement (CU, USDI, USGS, 1979). The most common sites discovered were lithic scatters (chipped stones), usually found in clusters. Cultures indicated in the inventories are the Paleo Indians, Desert Archaic, Fremont-Kayenta, Anasazi, and Ute-Southern Paiute. The coal region has a site density of approximately six sites per 640-acre section.

Several inventories have been completed in the coal mining area of southwestern Wyoming. Several time periods with related sites were indicated in the mining region, including Historic, Late Prehistoric, Middle and Early Prehistoric, and the Altithermal Periods. Site density ranges from 0.5 to 4.35 sites per section over the various surveys conducted. Buried sites could account for a still higher density (SW, USDI, BLM, 1978).

Information extracted from BLM site inventory files and consultant reports indicate that a number of site-specific inventories were completed on the Alton coal lease area in conjunction with coal testing programs. Sixteen archaeological sites were found within a 5-mile radius of the coal preparation plant, with five of the sites within a mile of the plant. The 16 sites range from 3 meters to 200 meters in diameter and are classified as lithic

scatters and camps. Only three of these sites have yielded ceramics of Anasazi or Southern Paiute origin and have shown evidence of structures. Intensive site-specific surveys of the area would be expected to find additional sites, and buried sites may exist in the area. Site density does not appear to be high, however, and sites of a similar nature to those described above would be expected. An average density of one site every 43 acres is expected in the Alton area.

All of the proposed slurry pipeline corridor was surveyed for cultural resources by the Desert Research Institute (Fowler, 1975; Turner et al., 1975). Because the exact route was not flagged, a corridor ranging from 800 to 1,500 feet wide was inspected. Fifty-three archaeological sites were recorded within or immediately adjacent to the corridor. Buried sites, however, are a distinct possibility in some areas. According to Fowler (1975), site types encountered were classed as Architectural, Open Camp, Rockshelter, Quarry (one only), Mescal Pit (one only), Petroglyph, and Lithic Scatter. Cultural affiliations indicated are Archaic, Anasazi, and Southern Paiute. The proposed slurry pipeline route would lie 0.25 mile north of Fort Pierce (fig. 2-4), which is on the National Register of Historic Places. Fort Pierce is an unroofed stone structure built during the Blackhawk War of the 1860s. The fort was designed to keep raiding bands of Navajo Indians from coming up Fort Pierce Wash into Washington and St. George, Utah.

The proposed slurry pipeline would be routed around an archaeologically rich and sensitive area known as Black Dog Cave/Moapa-Muddy Complex (Standard Operating Procedures, Appendix 6) which is located south of Moapa, Nevada. Black Dog Cave and one cluster of pre-ceramic basketmaker sites are of National Register caliber, although eligibility determinations have not been made.

Southern Utah State College archaeologists have completed an intensive inventory of approximately 75 percent of the Warner Valley powerplant site (Thompson and Thompson, 1976). The eight sites which were recorded in Warner Valley are classified as exploitive (raw material procurement), flaking, and camp (one only). Most of the powerplant site contains a light scattering of archaeological material.

Three historic trails are located within the immediate vicinity of the proposed Warner Valley powerplant: the Dominguez-Escalante, Honeymoon, and Temple Trails (fig. 2-4).

The Dominguez-Escalante Trail was the route used by the Dominguez-Escalante expedition in 1775-76 while searching for a more direct route between Santa Fe, New Mexico and Spanish settlements in southern California. The liquid waste disposal areas for the Warner Valley powerplant would be located on the route of the trail (fig. 2-4). The trail is currently being studied by the National Park Service for inclusion in the National Scenic and Historic Trails System.

The Honeymoon Trail is the route Mormon church members followed to be married in the temple at St. George, Utah. The trail traverses Warner Valley and runs approximately 1 mile south of the powerplant site (fig 2-4). The segment of trail between Lee's Ferry, Arizona and St. George, Utah has been nominated for inclusion in the National Register of Historic Places.

The Temple Trail from St. George, Utah through Warner Valley is essentially the same as the Honeymoon Trail (fig. 2-4). The trail was used to transport the wooden beams used in the construction of the St. George temple from Mt. Trumbull, Arizona.

The Warner Valley water project site has been inspected for cultural resource values (personal communication, Frank Hull, Staff Archaeologist, University of Utah, April 4, 1977); no sites or materials of archaeological or historical interest were located. The canal/pipeline systems associated with the project, however, have not yet been inspected and some potential exists for encountering sites in these areas.

The proposed diversion dam (which would divert water from the Virgin River to the Warner Valley Reservoir) would be located on the site of the historic Hurricane Canal/Diversion. The Hurricane Canal/Diversion system was built by early Mormon settlers to divert waters of the Virgin River to Hurricane farmland. The canal is particularly striking in areas where it appears to literally hang from the near-vertical Hurricane Cliffs. The system has recently been listed on the National Register of Historic Places. Included in the listing are the diversion structure and the first 6.5 miles of canal.

Areas which would be affected by construction and operation of the proposed Harry Allen plant have been extensively surveyed for cultural resource values. For those areas surveyed, no historical or archaeological sites of significance were encountered (Brooks, 1976; NPC, 1975).

The transmission system would consist of several geographically separate corridors. Where cultural resource data is incomplete or nonexistent, estimates of potential archaeological sites are based on an average site density of one site per 5 miles of linear distance of transmission line.

Spry to Alton. The corridor for this line has not been surveyed for cultural values. The nature and extent of cultural resources in the area crossed by this line are little known at present. An estimated 17 sites occur in this proposed corridor.

Warner to St. George. This proposed corridor has not been surveyed for cultural resource values. There are a number of cultural resource sites in the general area and exact alignment would determine whether or not any would be involved. It is estimated that four sites would be found in this 20-mile long corridor.

Warner to Pecos. The leg connecting the proposed Warner Valley powerplant with the existing Navajo-McCullough corridor has been surveyed for cultural resource values; no sites were found along the segment (Turner et al., 1975). The parallels to the existing Navajo-McCullough and Reid Gardner-Pecos lines have not been specifically examined. An estimated 24 sites occur in this proposed corridor.

Allen to Pecos. Cultural resource surveys have not occurred for either new segments or parallels to the existing Reid Gardner-Pecos line. This 16 mile long corridor contains an estimated three sites.

Allen to Eldorado. Portions of the Navajo-McCullough line have been surveyed with negative results (Turner et al., 1975). The parallels which would be included in the proposed project have not been surveyed. Approximately ten archaeological sites occur in this corridor based on average site densities.

Western Transmission System. The four alternative corridors of the Western Transmission System cross the Mojave Desert from the Eldorado substation in southern Nevada to the vicinity of the Lugo substation in California (fig. 3-8 located at the back of volume). The four alternatives have been sampled for cultural resources by University of California (Riverside) archaeologists (Baker, Rector, and Wilke, 1979). The results of the on-ground surveys are:

<u>Alternative Corridors</u>	<u>Right-of-Way (Length)</u>	<u>Approximate % of Corridor Surveyed</u>	<u>Number of Sites Found</u>	<u>Estimated No. of Sites in Corridor</u>
Interstate 15	175	33	15	35
Eldorado-Lugo	185	30	17	31
Victorville-McCullough	179	34	17	58
Highway 66	238	21	16	29

An ethnographic and historical resources study completed by Cultural Systems Research, Inc. (1979) lists several areas of high sensitivity involving the proposed Western Transmission System. The most sensitive ethnographic area is Spirit Mountain or Avikwame, the sacred place of creation for the Mojave, Quechan, Kamia, Diegueno, and Maricopa people of southern Nevada, western Arizona, and southeastern California (fig. 3-8).

Other areas of particular concern because of their significant archaeological and ethnographic resources are: the vicinity of the Mojave River near Toomey, California, Halloran Springs and vicinity, Mohawk Hill, Silver Dry Lake-Soda Mountains area, Cronese Valley and Mountains, and Victorville (fig. 3-8).

Recreation and Aesthetics

The visual resource is considered the most important aspect of recreation in the affected environment. The contrasting landscape of depositional valleys, upfaulted ridges, and deeply incised canyons, together with the exceptional air quality and visibility offer a variety of recreational activities such as sightseeing, hiking, and camping.

BLM has developed the Visual Resource Management System (VRM) which is used in classifying geographical areas according to their scenic character (BLM Manual 8400; Appendix 10). The system is used as a management tool in the evaluation of significant impacts to visual resources.

Recreational use within and adjacent to the central Utah coal fields consists primarily of: driving for pleasure and to gain access to the Scofield Reservoir and Manti-LaSal National Forest, sightseeing, fishing, picnicking and camping, and off-road vehicle (ORV) use. The Scofield Recreation Area and the Manti-LaSal National Forest (located a short distance from the coal fields) are the major areas of recreational use in the region.

Recreational use in the southwestern Wyoming coal mining region is mainly confined to sightseeing and ORV use. Sightseeing is generally limited to viewing wildlife. The majority of sightseeing visitor use occurs along U.S. Highways 30 and 189, which are major travel routes between Utah and Yellowstone and Grand Teton National Parks in Wyoming.

Bryce Canyon National Park comprising an area of some 35,835 acres, is located in south-central Utah in Garfield and Kane Counties. The park was visited by approximately 700,000 persons in 1978. Nearly 85 percent of the annual visitation occurs in the 6-month period between May and October. Sixty percent of the total visitation occurs in the 3 summer months of June, July, and August. Park visitation is expected to increase from 2.8 to 3.8 percent per year up to 1990 and between 0.8 to 5.8 percent up to the year 2014. The scenic views and rock formations at Bryce Canyon National Park are considered the most important aspects of visitor enjoyment (NPS, 1980). Approximately 300,000 of the total number of park visitors a year visit Yovimpa Point to enjoy the 3,000 square mile panorama visible from the rim of the Paunsaugant Plateau from the park. Yovimpa Point is the only place in southern Utah where the vista includes Kanab Canyon, the Coral Pink Sand Dunes, Kaiparowits Plateau, Kaibab Plateau, Navajo Mountain, and the Grand Staircase. The Grand Staircase is a series of cliffs which descend from Bryce Canyon National Park southward toward the Grand Canyon and include in descending order the Pink Cliffs, Grey Cliffs, White Cliffs, Vermillion Cliffs, and Chocolate Cliffs. Monitoring data from July through November 1979 indicates that visual ranges from Yovimpa Point overlooking the proposed Alton coal lease area are in excess of 112 miles 75 percent of the time, and in excess of 174 miles 10 percent of the time.

Solitude is also an important consideration in the enjoyment of the vistas and panoramas of Bryce Canyon National Park. In many cases the ambient or background noise levels in the park are lower than State of the Arts sound level instruments are capable of detecting. The background levels in the park are the lowest recorded by EPA's Region VIII office. Sound levels in the park frequently fall below 20 decibels (Foch and Oliver, 1980).

Approximately 10 miles of the extreme eastern section of the Alton East coal lease area is visible from Yovimpa Point. The lease area is in BLM's Visual Resource Management Classes II, III, and IV (fig. 3-9 located at the back of this volume). The lease area lies 4 to 6 miles from the overlook and has been modified by rangeland improvement activities, but essentially appears as a natural landscape. The landscape character of the lease area consists of a series of rolling hills covered with pinyon-juniper forests. Several areas cleared by pinyon-juniper chaining are distinguishable from Yovimpa Point as is a local airstrip.

The Alton lease area is primarily used for dispersed recreation, such as sightseeing, hiking, and ORV use.

NPS has recommended that the "Office of Surface Mining declare unsuitable those portions of the Alton coal field, which are adjacent to or visible from Bryce Canyon National Park". Specifically those areas of the Alton coal field, identified in the petition, which lie east of a north-south line of the east one-half of Township 40 South, Range 4½ west, Salt Lake Base Meridian, Kane County, Utah; a line which approximates Skutumpah Creek (fig. 3-10; NPS, SUPED hearing, Sept 29, 1980).

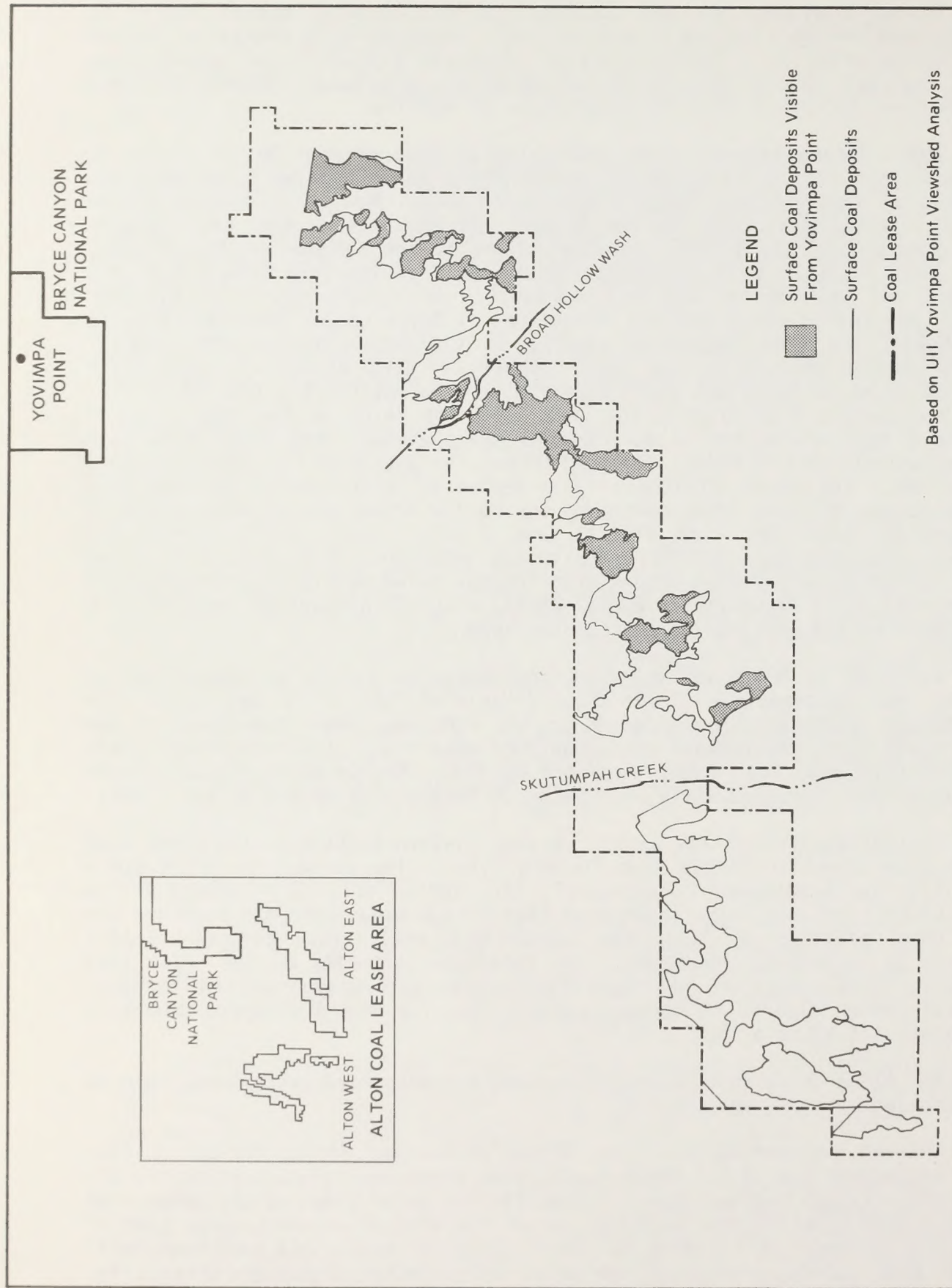


FIGURE 3-10

YOVIMPA POINT VIEWSHED ANALYSIS — ALTON EAST LEASE AREA

According to the Management Framework Plan, Summary for Coal Management in the Zion Planning Unit (USDI, BLM, 1980) approximately 600 acres of the Alton coal lease area would be unacceptable for surface mining under BLM unsuitability criteria because of the adverse effects on recreational values, visual resources, visibility, and noise at Bryce Canyon National Park. The areas unacceptable for surface coal mining operations would be those in the Alton East coal lease which are visible from Yovimpa Point and east of Broad Hollow Wash (fig. 3-10).

The quality of visual resources of the Warner Valley area varies with geology and topography. The topography of the valley itself is flat with a sparse cover of creosote bush and other arid-climate vegetation types. The valley is surrounded by uplifted cliffs and mountains, including the Hurricane Cliffs to the east, Sand Mountain to the northeast, and Warner Ridge to the west. The area is designated Class III and Class IV under the VRM classification system (fig. 3-9 located at the back of this volume). Recreational activities occurring in Warner Valley include sightseeing, rockhounding, and ORV use.

Zion National Park, comprising an area of some 146,550 acres, is located on the western extremity of the Colorado Plateau, approximately 20 miles northeast of Warner Valley. In 1979 the park was visited by approximately 1,200,000 persons. Generally, over 80 percent of the annual visitors come in the 5 months of May through September. Fifty-five percent of the total visitation occurs in June, July, and August. The visual resources at Zion National Park are considered one of the most important aspects of visitor enjoyment at the park and are dependent on the protection of scenic resources from unnatural degradation of visual range, color, and brightness contrasts. Visual ranges in excess of 100 miles occur 75 percent of the time (from Lava Point looking south-southwest toward Mt. Trumbull), and ranges in excess of 155 miles occur 10 percent of the time. Important vistas in the park include Watchman Point, which received approximately 2,165 visitors through September 1980, and Observation Point, which received approximately 5,274 visitors in the same year based on trail registration only.

The proposed coal slurry pipeline routes for the 73-mile, 12-inch diameter Warner Valley pipeline and the 183-mile long, 22-inch diameter Harry Allen pipeline would cross areas of VRM Classes II, III, and IV (fig. 3-9). Class II areas of White Cliffs near Upper Kanab Creek, at the Hurricane Cliffs, and on the Beaver Dam Mountains are characterized by extremely steep topography. The slurry pipeline route would pass through approximately 3 miles of Coral Pink Sand Dunes State Reserve, but would be confined to an existing transportation corridor (Standard Operating Procedures, Appendix 6). The 3,730-acre reserve established by the State of Utah is primarily used for ORV operation, hiking, and sightseeing. Sand dunes with interesting scenery and suitable terrain to serve sightseers and ORV enthusiasts are the primary features of the reserve. The slurryline would also pass within 1.5 miles of the Joshua Tree National Natural Landmark in the Beaver Dam Mountains in Utah.

The scenic quality at the proposed Harry Allen plant site at Dry Lake, Nevada is typically arid with little vegetation on a desert landscape. The flat terrain of Dry Lake contrasts sharply with upfaulted ridges to the west. The plant site and adjacent lands have been classified as Class III areas according to the VRM system (fig. 3-8).

Phase I of the two-phase Nationwide Rivers Inventory (conducted by the Heritage Conservation and Recreation Service) has identified one stream within the Allen-Warner Valley EIS area which may be suitable for inclusion in the Wild and Scenic Rivers System: the Virgin River from Lake Mead to the Highway 17 bridge near Hurricane, Utah.

The Virgin River provides excellent opportunities for seasonal rafting, kayaking and canoeing. Rafting conditions vary with seasonal character, depending on annual snow and rainfall, temperatures and other weather factors. The best opportunities for river running occur in the late spring and early summer during the spring runoff. The flow rate of the Virgin River ranges from approximately 20 ft³/s to 9,000 ft³/s, with the most desirable flow rates for river running occurring between 500 and 5,000 ft³/s. Existing use of the river during the spring runoff season ranges from approximately 50 to 100 people per week. River running on the Virgin River is increasing in popularity and a river outfitting service has expressed a desire to develop a commercial outfitting service.

Most of the proposed electrical transmission system corridors would cross from southwestern Utah to southern California. Scenic quality in these areas varies with local topography and geology. The quality of visual resources varies from Class II through Class IV under the BLM visual resource management system. Figures 3-8 and 3-9 indicate the location of each segment and its VRM rating. Recreationists use these desert regions primarily for sightseeing and ORV use.

Spry to Alton. The proposed 84-mile transmission line would pass through essentially rural and forest settings. Much of this land is of low visual quality and has a Class IV VRM rating.

Warner to St. George. The proposed 20-mile 138-kV transmission line would pass through VRM Classes II and III areas around the city of St. George and Class IV areas in Warner Valley.

Warner to Pecos. This double circuit, 345-kV transmission line would parallel the existing Navajo-McCullough and Reid Gardner-Pecos corridors for the majority of the route. The proposed route would traverse VRM Classes II, III, and IV in Utah and Class III areas in Nevada. The transmission line would pass within 1.5 miles of the Joshua Tree National Natural Landmark in southern Utah.

Allen to Eldorado. The proposed transmission line would parallel existing transmission lines for approximately 43 of the 48 miles. While paralleling the existing Navajo-McCullough transmission corridor, the line would run approximately 2 to 3 miles from the Frenchman Mountain-Rainbow Gardens area and pass through Las Vegas Wash. Rainbow Gardens, which contains an array of colored rock formations, is being considered for nomination to the National Natural Landmarks Program by the Heritage Conservation and Recreation Service. The Las Vegas Wash is being studied by Clark County Parks and Recreation and Comprehensive Planning Departments for potential development as a Wetlands Park. Rainbow Gardens is also being considered for development and incorporation into the Wetland Park System.

Western Transmission Sytem

Interstate 15. Much of the environment through which the corridor would pass is of moderate to low visual resource and is not unique. The I-15 corridor would follow the existing transmission corridor through McCullough Pass in Nevada and pass adjacent to Afton Canyon in California. These areas have been identified as being potential candidates for the National Natural Landmarks Program by the Heritage Conservation and Recreation Service.

Eldorado-Lugo. This route would essentially run parallel to existing 220-kV and 500-kV powerlines. The proposed route would bisect Kelso Dunes/Devil's Playground area and pass approximately 2 miles from Pisgah Crater. The Heritage Conservation and Recreation Service has identified these areas as potential candidates for the National Natural Landmarks Program. Other areas of interest along the proposed route include Cinder Cone Natural Area, Cadiz Mountains, and the proposed East Mojave National Park.

Victorville-McCullough. This proposed corridor would follow an existing corridor through McCullough Pass in Nevada. This area has been identified as a potential candidate for the National Natural Landmarks Program by the Heritage Conservation and Recreation Service. Other areas of interest along this route include Daggett Ridge, Roach Lake, Red Pass Lake, Silver Lake, Shadow Lake, the Clark Mountains, and the proposed East Mojave National Park.

Highway 66. The major portion of this alternative corridor is presently without transmission lines. The proposed corridor would pass approximately 1 mile from Amboy Crater National Landmark, Pisgah Crater, and the Piute Range. Pisgah Crater and the Piute Range have been identified as potential candidates for the National Natural Landmarks Program.

Wilderness

In accordance with the Federal Land Policy and Management Act of 1976 (FLPMA), BLM has been mandated the responsibility of reviewing all public land roadless areas of 5,000 acres or more to determine their suitability for wilderness designation. BLM's role in the wilderness review process involves three phases: inventory, study, and reporting its recommendations to Congress on which Wilderness Study Areas (WSA) are suitable or unsuitable for Wilderness designation. Only Congress can designate areas for inclusion to the National Wilderness Preservation System.

Four BLM Intensive Wilderness Units are within the influence zone of the AWP energy system in southern Utah (fig. 3-9). These units include Cottonwood Canyon (UT-040-138), East Mesa (UT-040-3-5), Quail Draw (UT-040-134), and Upper Kanab Creek (UT-040-255). These units have been recommended to be dropped from further Wilderness consideration. Final decisions will be announced on November 15, 1980. Three Intensive Wilderness Inventory Units in Arizona which were included in the draft EIS, have also been dropped from further Wilderness consideration.

There are no WSAs or Intensive Inventory Units in the project's influence zone in Nevada. The proposed Western Transmission System alternatives would be routed across the Mojave Desert of southern California. The Highway 66, Eldorado-Lugo, and Victorville-McCullough alternatives would be routed

through WSAs (fig. 3-8). The Interstate 15 alternative would not be routed through any WSAs.

These Wilderness Study Areas are managed under an "interim" policy so as not to impair their suitability for preservation as wilderness. The "interim management" will continue until such time that Congress declares the WSAs as official Wilderness Areas or as nonwilderness areas (FLPMA).

Land Use, Land Use Plans and Controls

Current land use patterns and land use plans and controls for the Alton coal lease area are described specifically in the Office of Surface Mining draft SUPED (USDI, 1980). Public (BLM), State, and private lands occupy the area of proposed coal development. On public lands the proposed mining area lies within the BLM Zion Planning Unit, which provides for coal mining under a multiple-use basis, recommending stringent environmental controls on those areas where land is acceptable for mining. According to the Management Framework Plan, Summary for Coal Management in the Zion Planning Unit (USDI, BLM, 1980), approximately 600 acres of the Alton coal lease area would be unacceptable for surface mining operations under BLM unsuitability criteria because of adverse effects to the recreational values at Bryce Canyon National Park, including visual resources, visibility, and noise (fig. 3-11). The area also includes a 40-acre public water reserve administered by BLM. The reserve must be protected from contamination or a reduction in size, and excludes surface mining as an appropriate land use.

The Las Vegas District of BLM is currently working on the establishment of designated transmission and pipeline corridors as part of its planning system for the BLM Clark County Planning Unit. The planning process is multifaceted and includes public participation at various levels, including the Clark County Grazing EIS, currently scheduled for publication in draft form April 24, 1981. This grazing EIS will include an analysis of designated corridors and their impacts on grazing allotments.

Kane County is in the process of updating the county's master plan and zoning ordinance so that it could permit surface and underground mining in the county. The existing zoning ordinance identifies two zones that pertain to the lands in the area proposed for mining: the "forest-recreation zone" and the "agricultural zone." The forest-recreation zone permits underground mining. Surface mining is a conditional use, which means such use must be approved (upon application) by the County Planning Commission. In the agricultural zone, mining is not a permitted or conditional use because, "...uses inimical to the continuance of agricultural activity are not allowed" (Kane County Utah Zoning Ordinance, 1975). The Alton coal lease area is zoned forest-recreation except for an area near the town of Alton, which is zoned agricultural. The primary use on public, State, and private land in the Alton area is agricultural, specifically livestock grazing. There is a small amount of irrigated and nonirrigated cropland which produces feed for cattle. There is no prime farmland in the area (SU, USDI, USGS, 1979).

The proposed coal slurry pipeline route would cross public, State, and private lands in Utah, Arizona, and Nevada. It would run through 3 miles of Coral Pink Sand Dunes State Reserve, located in southwestern Utah.

The management plans of both Zion and Bryce Canyon National Parks include among other objectives: to secure, through research or other means, adequate information to optimize management efficiency and to ensure long-term conservation of park resources; and to cooperate with outside agencies, organizations, and members of the public in assuring, to the greatest extent possible, that nearby lands are developed and managed in ways that are compatible with preserving the parks' air and water quality, geological resources, ecological communities, and scenery for which the parks are famous (Assessment of Alternatives, USDI, NPS, 1979).

A bill presently before both Houses of Congress would expand the existing Moapa Indian Reservation in southern Nevada (fig. 3-8). Some of the lands included in the proposed expansion would be needed for construction of proposed electrical transmission lines and a coal slurry pipeline. The House bill (HR 5584) has provisions that would grant the land subject to existing rights-of-way, and a proposed corridor 1,500 feet to either side of the existing Navajo-McCullough transmission line that would be administered by the Secretary of the Interior, but the Senate bill does not. Also, the boundary location of the proposed extension could potentially affect the location of one of the settling ponds at the Allen site.

The proposed truck route to be used for transporting coal from the Alton coal fields to the Warner Valley powerplant (Alternative 3) would be subject to the 1979 Utah Statewide average of 4.15 accidents and 0.034 fatalities per million motor vehicle miles traveled (personal communication, Steve Glines, Utah Division of Highway Safety, March 14, 1980).

The Warner Valley sites for the proposed powerplant and water project are currently zoned "open space" by the Washington County Planning Commission. BLM planning regulations under the Management Framework Plan for the Virgin River Planning Unit - Dixie Resources Area (1977) allow for the transfer of ownership or granting of rights-of-way for use of public lands.

The proposed Harry Allen powerplant site is currently zoned "rural open" by the Clark County Comprehensive Planning and Environmental Commission. BLM planning regulations under the Management Framework Plan of the Virgin Valley Planning Unit - Caliente Resource Area (1974) allow for the sale or granting of a right-of-way permit for use of public land as a powerplant site. The current use of land at the site is open range.

The principal use of lands proposed for transmission system routing is open range. Approximately 80 percent of all lands that would be involved with transmission line construction is administered by BLM, which provides for the granting of rights-of-way for such routes (Federal Land Policy and Management Act of 1976).

The Henderson, Nevada Planning Council has recommended to the city council that they deny permits for use of lands within Henderson's incorporated city limits for the routing of the electrical transmission system for the AWP energy system (personal communication, Rich Eckenberg, City Planner, City of Henderson, October 9, 1980). The approximately 5,800 acres of land involved was incorporated by State legislative and city initiatives in 1967, 1971, and 1972. U.S. Senate Bill S22/54 has recently been introduced to convey title of this land officially to the city (title currently lies with the United States).

The Mojave Desert of southern California is currently under study by BLM for management purposes under the proposed California Desert Conservation Area Plan (Sec. 601, Federal Policy and Management Act of 1976). BLM has recently published the final EIS and proposed plan concerning the area (California Desert Conservation Area Final Environmental Impact Statement and Proposed Plan, September, 1980). The management plan includes the designation of utility corridors to allow for the routing of transmission lines and pipelines through the California desert area.

Socioeconomics

Central Utah Region

This region consists of portions of Carbon, Emery, Piute, Sanpete, Sevier, and Wayne Counties. The general area has had a mixed character historically and is by no means homogeneous. Carbon and Emery Counties have long been involved with the mining of coal and their economies have developed around mining and associated activities. The economies of Piute and Wayne Counties have been primarily based on agriculture and trade, and Sanpete County has a split economic base with substantial agricultural and manufacturing sectors. The region itself is sparsely populated with nearly half of its population concentrated in Carbon and Emery Counties, primarily in the towns of Price, East Carbon, and Helper.

All socioeconomic data for this region is based on information contained in Development of Coal Resources in Central Utah Environmental Statement (CU) (USDI, USGS, 1979).

Population. The population of the region was estimated at just over 60,000 persons in 1977. Of this amount, Carbon County accounted for 20,500 (34 percent), Emery 9,300 (15 percent), Piute 1,400 (2 percent), Sanpete 13,400 (23 percent), Sevier 13,700 (23 percent), and Wayne 1,800 (3 percent). Historical population figures indicate that the entire region has just reversed a nearly 20-year period of decline. Beginning around 1950, the region's population began to decline from just over 61,000 to around 51,500 in 1960 and 44,500 in 1970. By 1975 this trend had begun to reverse itself and populations had increased to just over 51,000. By 1977 the population was again above 60,000. The central Utah region therefore has considerable experience with major shifts in population, both out of and into the area, and has most recently been experiencing significant inflows of people. According to the Utah Population Work Committee (Kirkham, 1979) the current population is approximately 66,000, which would be an average annual growth rate of nearly 5 percent a year between 1977 and 1979. Such growth rates would continue or increase if regional coal development progresses at its current rate.

Employment and Income. Employment and income in the region have fluctuated proportionately with population, declining from 1950 through 1970 and then rising to or above earlier levels. Over the 25-year period of 1950 to 1975, agricultural employment experienced an almost continual decline in the region. Governmental employment in the region experienced an almost continual increase, while such sectors as manufacturing, mining, construction, and trade fluctuated, but are currently on the rise. The region's dependence on coal mining and related activities, especially in Carbon and

Emery Counties, is the predominant basis for such fluctuations. As mining activity in the area increased or decreased, ripple effects generated similar changes in related sectors. Such relationships would be expected to continue into the future.

Total personal income in the region has been estimated at \$239.3 million for 1975. There is, however a large variation between counties, with Carbon - \$94.6 million, Sevier - \$52.4 million, Sanpete - \$47.9 million, and Emery - \$33.8 million. The figures then drop markedly to \$6.2 and \$4.4 million for Wayne and Piute Counties respectively. The per capita personal incomes for the region at the same time were below the national average of \$5,852, with Emery - \$5,475, Carbon - \$5,176, Sevier - \$4,517, Sanpete - \$4,045, Wayne - \$3,568, and Piute - \$3,497. The higher levels attained by Carbon, Emery, and Sevier Counties reflect their heavier involvement in mining, construction, and manufacturing, which tend to have higher wage rates than other employment. The figures for the remaining counties are indicative of a high proportion of nonworking-age people in the population (predominately the elderly), lack of high paying jobs, and relatively high unemployment rates. Such intercounty variation would be likely to continue, even with accelerated coal development in the region. This would occur primarily because such development would be likely to concentrate in Carbon and Emery Counties.

Services. The adequacy of services throughout the region varies by county. Communities in Carbon and Sanpete Counties exhibit the greatest adequacy in provision of such services as public water supply, police and fire protection, parks and recreation, and sewage disposal. Communities in Sevier and Wayne Counties tend to be less adequately equipped to supply services, especially in the area of sewage disposal. Housing availability in the region is stable in most counties except Carbon and Emery. In the latter two, population increases since the early 1970s have resulted in chronic housing shortages. Carbon and Sevier County school systems are currently capable of accommodating only moderate growth in enrollments. The other school systems in the region are currently either at or in excess of their designed capacities, and any additional enrollments would aggravate existing problems.

Quality of Life. Lifestyles in the central Utah region are quite diverse. The region is much less homogeneous than in any other areas in the State, and as a result is more capable of absorbing changes in population and economic activity without undergoing socio-cultural upheavals. However, recent trends of increased population in the region have begun to exceed infrastructural capacities in some areas. If such trends go unresolved in the face of potentially higher rates of growth, the general level of the quality of life in the region could be severely diminished. That is, the likelihood of "boom-town" proportioned problems would be high, especially in Carbon and Emery Counties, where the potential growth is most likely to occur.

Southwestern Wyoming Region

This region is the extreme southwestern corner of Wyoming, bordering Utah to the west and Colorado to the south. It contains three counties: Sweetwater, Lincoln, and Uinta, with Sweetwater County being dominant in terms of socioeconomic activity. The historical character of the region has

been oriented around an open range, rural ranching type economy. More recently however, the rural character of the area has been increasingly influenced by mining and energy related activities including phosphate, oil, gas, coal development, and electrical power production.

All socioeconomic data for this region is based on information contained in Development of Coal Resources in Southwestern Wyoming Environmental Statement (SW) (USDI, BLM, 1978).

Population. The population of the region was estimated at nearly 60,000 in 1977. This figure represents a significant increase (75 percent) over the relatively stable 1970 base population of around 34,000, an average annual growth rate of approximately 11 percent. Such growth trends are extremely difficult to accommodate and have resulted in "boom-town" conditions in Sweetwater County (primarily Rock Springs and Green River).

Employment and Income. Total employment in the region was estimated at about 28,000 in 1977, an 81-percent increase over 1970 levels of around 11,000. Of this, about 40 percent was attributed to the mining and construction sectors, 15 percent in the trade sector, 13 percent in the government sector, and only 5 percent in the agricultural sector.

As with employment, incomes in the region have risen significantly, especially in Sweetwater County. Total personal incomes in the region in 1977 were estimated at \$342.8 million, representing an average of over \$12,000 per person employed. Of the total regional income, nearly 75 percent or about \$258.4 million was concentrated in Sweetwater County. However, despite such relatively high income figures (nearly 50-percent higher in Sweetwater County than the national average for the same period), considerable variation in earning power exists between the various sectors of the region's economy and between the three counties. Uinta County has been least affected by the economic growth of the region since actual developments have been concentrated in Sweetwater and Lincoln Counties. Also, employees in other sectors have not acquired wage rates as high as those in the mining and construction sectors (typically only 40 percent as high), resulting in a migration of employees from the service and retail trade sectors to mining and construction.

Services. Rapid population increases in the region have significantly strained the capabilities of municipalities to provide services to residents. Some of the more acute problem areas include housing shortages, potential overcrowding in schools (most school districts are currently operating at or near their capacities), unmet basic health care needs, and increased law enforcement problems. Such deficiencies are most prevalent in Sweetwater and Lincoln Counties, but also exist to a lesser degree in Uinta County. Growth-related problems, such as the above, would eventually be resolved as growth rates stabilize, but such a process could take a number of years.

Quality of Life. Perceptions of the quality of life in the region vary, depending upon the degrees of change that have taken place in the various counties and their communities. The most dramatic recent impacts to quality of life have occurred around Rock Springs and Green River, where change has been rapid and far-reaching. The past rural atmosphere of the

area has been transformed to one of "boom-town" conditions and a largely degraded quality of life.

Southern Utah and Southern Nevada Regions

These regions include two counties in southern Utah (Kane and Washington) and one in Nevada (Clark). The most populated portion of Kane County is along its western side, especially along Utah Route 89. The primary population centers are Kanab, Orderville, and Glendale. In Washington County the primary areas of concern are centered in two areas: Hurricane, including LaVerkin, Toquerville, and Leeds; and St. George, including Washington, Santa Clara, Ivins, and unincorporated areas such as the Bloomington area. In Clark County, Nevada, the situation is somewhat different. The area of concern is in what is known as the Las Vegas Valley, which includes the jurisdictions of Las Vegas, North Las Vegas, Henderson, and the unincorporated portions of the county between the areas mentioned. In all three counties, the vast proportion of the countywide populations (over 90 percent) is situated within the designated areas of concern. The character of the region is dominated by scenic attractions such as Zion National Park, Lake Powell, Grand Canyon, Lake Mead, etc. Most of the region is sparsely populated and is characterized by small homogenous communities. The main exception to this characterization is Las Vegas, which is the largest population center in the region and has a very diverse population.

Socioeconomic data for the southern Utah and Nevada regions has been developed through a variety of the sources. The State of Utah office of the State Planning Coordinator has provided growth projections for the two southern Utah counties. Centaur Associates, Inc., a BLM contractor, has generated the growth projections for the southern Nevada area (following Nevada's Demographic and Economic Simulation Model). Where possible, 1980 has been utilized as the base year to take advantage of the newly available Preliminary 1980 Census data. However, all projections are based upon trends that have been observed for these regions over a number of years, not just for the base year. Also, the following sections summarize existing situations in the regions, and more detailed information is provided in the tables of Appendix 11.

Population. The Preliminary 1980 Census population figures for Kane and Washington counties indicate a total population of approximately 29,000. The population of each county is listed at: 3,929 for Kane County, a 51.7 percent increase over the 1970 Census level; and 24,901 for Washington County, an 82.2 percent increase over 1970 levels (table 1, Appendix 11). Compound annual growth rates in Kane County for the 1970-1980 period have been moderate, slightly over 5 percent per year. For Washington County communities, growth has been quite variable. The overall 1970-1980 annual compounded rate of growth for the county has been a little over 5 percent. However, for communities within the county, growth rates range from 2.4 percent for Leeds, to 15.8 percent for Ivins. Much of the region's growth is attributable to its favorable climate and its attraction to retirement-aged persons as a winter residence area. For detailed figures on population trends, current levels, and baseline projections, refer to table 1 of Appendix 11.

The 1980 population of the southern Nevada region (essentially the Las Vegas Valley area) has been estimated at approximately 608,000. Populations

in the Las Vegas Valley area have been growing over the past several years at the relatively rapid rate of 7 to 10 percent per year. Much of this growth is attributable to the area's warm, dry climate, the tourist industry, and the gaming industry.

Growth rates for the two regions for the 10-year period 1970-1980 are:

<u>Community</u>	<u>Annual Compound Percent Growth</u>
Kane County	5.0
Alton	1.9
Glendale	1.6
Kanab	4.2
Orderville	0.7
Washington County	5.4
Hurricane	5.4
Ivins	15.8
LaVerkin	9.7
Leeds	2.4
St. George	4.6
Santa Clara	14.6
Toquerville	4.3
Washington	11.5
Clark County	5.7

Employment and Income. Employment and income in Kane and Washington Counties are dominated by three sectors of the economy: trade, services, and government. Estimates for 1980 employment levels in Kane County show around 67 percent of the county's total employment in these three sectors, and nearly 70 percent for Washington County in the same sectors. Incomes for the two counties follow similar patterns, with over 62 percent of countywide income in Kane County being attributable to trade, services, and government, and over 56 percent for Washington County attributable to these sectors. The large proportion of the regional economy occupied by the trade and service sectors (nearly 50 percent) is indicative of the region's high dependence on the tourist industry which has resulted from the area's numerous national parks, monuments, and recreation areas. Detailed projections for employment and income for these areas are located in tables 2 and 3 respectively in Appendix 11. Estimates of current conditions are:

<u>Sector</u>	<u>Kane County</u>		<u>Washington County</u>	
	<u>No. of Jobs</u>	<u>Income^a</u>	<u>No. of Jobs</u>	<u>Income^a</u>
Agriculture	108	1.07	568	13.94
Mining	0	0	17	0.28
Construction	75	1.71	551	7.61
Manufacturing	84	0.53	729	8.25
T.C.U.	46	0.53	314	5.96
Trade	281	1.89	2,680	21.10
FIRE	28	0.25	390	4.04
Services	281	2.77	1,371	13.94
Government	253	2.01	1,866	16.51
Total	1,216	10.74	8,482	91.72

Source: See Tables 2 and 3 of Appendix 11.

^aIn millions of 1977 dollars.

As with the southern Utah region, southern Nevada employment and income is dominated by three sectors of the economy: trade, services, and government, which account for over 80 percent of total employment and 75 percent of total income. However, in contrast with the southern Utah region, the dominant sector in southern Nevada is services, reflecting the area's high involvement with the gaming and entertainment industries. Sectoral breakdowns for employment and income in Clark County are estimated as:

<u>Sector</u>	<u>Number of Jobs</u>	<u>Income^a</u>
Agriculture	695	16.37
Mining	201	3.22
Construction	8,976	182.13
Manufacturing	7,585	125.43
TCU ^b	12,110	234.22
Trade	38,630	412.88
FIRE ^c	7,559	107.31
Services	92,740	1,246.70
Government	33,950	411.44
Total	202,446	2,739.31

Source: See Tables 2 and 3 of Appendix 11.

^aIn millions of 1977 dollars.

^bTCU = transportation, communication, and utilities

^cFIRE = finance, insurance, and real estate

Services. Six basic service types (law enforcement, fire protection, provision of water, sewage disposal, education, and health care) have been utilized to represent a common base for analysis of services in the southern Utah and southern Nevada regions. Detailed baseline and projection statistics for the various service types are contained in tables 4 through 9 in Appendix 11; summaries are provided below.

The current adequacy of services in the southern Utah region varies somewhat between Kane and Washington counties. For most communities such services as law enforcement, fire protection, and staffing the school systems for educational needs are generally adequate for current demands. Provided that as in the past, staffing for these service types is expanded as population and demands grow, no major problem areas are anticipated through the year 2000. The more capital-intensive service types such as water and sewage systems, health care facilities, and school facilities are anticipated to present some problems on a community by community basis. Although most Kane County communities appear to have ample water supplies through the year 2000, Kanab is projected to have demands in excess of its water supply sometime between 1990 and 1995. The Washington County communities of St. George and Santa Clara are projected to need additional sewage treatment capacity between 1985 and 1990, and both Ivins and Washington are currently in a borderline position. Sewage treatment in the Hurricane area has been a major problem, but with improvements now in progress, the situation should be remedied. For both counties, school and health care facilities are at or near their capacities.

The southern Nevada region is in a situation much the same as described for the southern Utah region. As population influxes continue, staffing for

law enforcement, fire protection, and education must be expanded to keep pace. Sewage treatment facilities for the Las Vegas Valley area appear to be at or near their capacities. There are, however, plans for expansions to meet future needs. It also appears that school and health care facilities will need to be expanded in the near future to meet the needs of population growth in the area.

The table below summarizes the points in time that the capacities of existing services or those currently under construction would be exceeded by baseline population growth. The information contained in the table is a composite of material found in tables 4 through 9 in Appendix 11.

	<u>Law Enforce- ment Needs</u>	<u>Fire Pro- tection</u>	<u>Water Needs</u>	<u>Sewage Treatment Needs</u>	<u>School Staff Needs</u>	<u>Health Care Needs</u>
Kane County						
Alton	a	a	b	b	1985-1990	a
Glendale	a	b	b	a	1985-1990	a
Kanab	a	b	1990-1995	a	1985-1990	a
Orderville	a	b	b	a	1985-1990	a
Washington County						
Hurricane	a	b	b	b	a	a
Ivins	a	a	b	a	a	a
LaVerkin	a	a	b	b	a	a
Leeds	b	a	b	b	a	a
St. George	a	1995-2000	b	1985-1990	a	a
Santa Clara	a	1995-2000	b	1985-1990	a	a
Toquerville	a	a	b	b	a	a
Washington	1985-1990	a	b	a	a	a
Clark County						
Las Vegas Valley	a	1985-1990	b	a	a	a

^aExisting facilities already at or near capacity.

^bExisting capacities not projected to be exceeded before the year 2000.

Note: Those services which are primarily personnel oriented (law enforcement, fire protection, and school staffing) are adjusted yearly to fit needs, and as a result can appear to be chronically borderline in terms of adequacy if one only considers the statistics alone. In contrast, high capital items such as water and sewage systems, which are not readily changed on a year to year basis are usually constructed with excess capacity to accommodate growth up to a certain point, and then appear to break down. Such appearances are a function of the statistics, and should not be interpreted as poor planning.

As indicated above, most infrastructural services in both regions are presently adequate (with a few deficiencies). However, with overall growth rates at around 4 to 8 percent, any existing margins will be rapidly consumed unless aggressive service development is undertaken. Detailed statistics on service levels are located in tables 4 through 9 in Appendix 11.

Quality of Life. The large population migration into most of the southern Utah region attests to its general high quality of life. The overall character of the region is one of a rural "western" setting.

The Las Vegas area offers a somewhat different setting, one of a predominantly "western" city combined with the glamor of the gaming industry. The population is very heterogenous, containing immigrants from both the east and west and with minority configurations very close to national averages. Those attributes which form the region's high quality of life should continue at least into the near future, especially if services are provided in pace with population growth.

Western Transmission System Region

The Western Transmission System traverses portions of both Clark County, Nevada and San Bernardino County, California. Since descriptions of Clark County are given above, the descriptions here are confined to the California portion.

All four potential Western Transmission System routes lie entirely in San Bernardino County and run across an area which is sparsely populated. The routes traverse the Mojave Desert where, with only a few exceptions, no development has taken place. As such, the affected environment tends to be more in physical terms than socioeconomic terms.

All socioeconomic data for this region is based on information contained in Allen-Warner Valley Energy System - Proponents' Environmental Assessment (SCE and PG&E, 1979).

Population. The population of the region was estimated at 147,831 for 1979. Nearly 94 percent of this figure is concentrated in the western portion of the region, around Victorville, Barstow, and Twentynine Palms. Between 1970 and 1979, the region as a whole experienced a net 3.1 percent annual increase in population, with most of the actual growth experienced in the Victorville and Twentynine Palms areas.

Employment and Income. Employment in the region has traditionally been oriented around the service and trade economic sectors. The major industries are retail trade and services, transportation, and public utilities. Much of the income in the region comes in the form of tourist trade. The average per capita income in the region was estimated at around \$7,200 in 1979, which compares very favorably with the national average. The region is likely to experience a continuation of such conditions in the near future since there are no proposals for major development.

Services. A study of the region (SCE and PG&E, 1979) has shown no major infrastructural deficiencies. The moderate growth rate of the whole area should be readily accommodated, although the higher growth rate areas of Victorville and Twentynine Palms could experience some problems with annual growth rates of 4.5 and 5.9 percent respectively.

Quality of Life. Lifestyle of the region is dominated by a rural and open country character.

Coal Resources

USGS has estimated that there are total reserves of 295 million tons of coal with an overburden of less than 200 feet (strip minable), and a total of

349 million tons of coal with an overburden greater than 200 feet (underground minable) in the Alton coal lease area (Kohler, 1980). Kohler also estimates that recoverable reserves in the Alton coal lease area are 240 million tons with less than 200 feet of overburden, and 395 million tons with more than 200 feet of overburden. NPC (1975) estimates inplace surface minable reserves in the Alton coal lease area are 212 million tons, and recoverable underground reserves are 100 million tons, with the average quality for this coal in the Alton lease area estimated at 9,647 Btu/lb., 17.27 percent moisture, 1.11 percent sulfur, and 9.35 percent ash. Recent samples by UII indicate the average quality for coal in the Alton lease area is 9,585 Btu/lb, 17.71 percent moisture, 1.02 percent sulfur, and 9.64 percent ash (SUPED, 1980). This coal is ranked as sub-bituminous. There is no active mining presently taking place in the Alton coal lease area.

Total reserves in the central Utah coal fields are estimated at 13,974 million tons, essentially all of which is under greater than 200 feet of overburden (underground). Approximately 50 percent (6,987 million tons) is recoverable by underground mining methods. Average quality of central Utah coal is 12,600 Btu/lb, 6.1 percent moisture, 0.45 percent sulfur, and 6.5 percent ash. This coal is classified as bituminous (CU, USDI, USGS, 1979). Current production (1979) from about 25 coal mines in central Utah is approximately 12.3 million tons annually, with current unsold stockpiles of over 1 million tons (SUPED, 1980). USGS (CU, USDI, 1979) analyzed several production scenarios for the central Utah coal field, including a projected "high level" production level of 42 million tons per year by 1990. The actual production level would depend on the establishment of coal markets.

Total reserves in the southwestern Wyoming coal fields are estimated at 20.7 billion tons for all categories (bituminous and sub-bituminous). Most of this coal underlies more than 200 feet of overburden, although there are surface outcrops. Average coal quality is 9,827 Btu/lb, 18.4 percent moisture, 0.54 percent sulfur, 7.38 percent ash. The coal is classified as sub-bituminous. Current production is estimated at 10.8 million tons per year, of which 10.3 million tons is strip mined. BLM (SW, USDI, 1978) analyzed several production scenarios for the southwestern Wyoming coal field, including a projected "high level" production level of 35.6 million tons per year by 1990. The actual production level would depend on the establishment of coal markets.

Several coal availability surveys have been conducted in order to quantify the amount and costs of coal (or coal capacity) available in the 1985 to 1990 timeframe from various coal producers in the western United States. These surveys include: the Allen-Warner Valley Energy System survey by Morrison-Knudsen, Inc. for NPC, PG&E, and SCE (1980); the California Coal Project survey by SCE (1979); the "Availability and Cost of Coal for the Allen-Warner Valley Energy System" survey by the California Public Utilities Commission Allen-Warner project team staff (1980) in connection with their licensing procedures for the proposed AWV for PG&E and SCE; a comparative coal costs analysis done by Eureka Energy Company, a fully owned subsidiary of PG&E (McCoy, 1980); and an analysis by OSM (SUPED, 1980); and an analysis by OSM (SUPED, 1980) of comparative economic advantage of coals delivered to the Allen powerplant in Nevada.

The Morrison-Knudsen survey is not available to BLM because it is considered privileged information to the applicants. The California Coal Project survey found an annual availability of 105 million tons of coal, of which 46 million tons is of medium to high Btu/lb and of low sulfur content. Of the 46 million tons, 10 million tons were indicated to be excess production, 7 million tons were expansion production, and 29 million tons were indicated as new production.

CPUC Allen-Warner project team compared Alton coal to alternative sources of coal delivered to the proposed Harry Allen powerplant site. Their computations showed that for the mid-1980s the least expensive coal railed to the plant site on existing trackage from existing coal producing areas would be less expensive by approximately 10 percent than Alton coal slurried to the plant site after consideration of coal qualities and handling and transportation costs.

Eureka Energy Company's analysis shows a 1980 comparative cost advantage for central Utah coal over Alton coal, and an advantage of Alton coal over southwestern Wyoming coal. Projections by Eureka to the year 1990 assume a greater escalation (inflation) in the costs of underground mining and rail transportation than for surface mining and slurry transportation; and based on these assumptions, Eureka finds that in 1990, Alton coal would be cheaper than central Utah or southwestern Wyoming coals by 14 and 20 percent respectively.

OSM, using the USGS Coal Transportation Model which includes mining, transportation, and coal scrubber costs, finds that in 1990, other western United States coals can be made available to the Allen-Warner Valley energy system (here assuming only the Allen powerplant near Las Vegas, Nevada) at an economic advantage over Alton coal. The OSM projection assumes constant 1978 dollars without inflation (OSM updated from SUPED, 1980).

Existing and Projected Electrical Energy Demand

The existing and projected levels of electrical energy demand (peak demand) for the service areas of the city of St. George (Utah), NPC (Las Vegas, Nevada), PG&E, and SCE service areas in California are presented below.

City of St. George Service Area

The St. George City Utilities Department contracted a report done by Burns and McDonnell (1977) which it considers the best forecast of its electrical energy needs (Chapter 1, Purpose and Need). BLM, however, contracted Centaur Associates to make an independent assessment of the energy demand for the city of St. George service area.

The existing (1979) levels of electrical energy demand were taken from "Energy Conservation Alternative for the Allen-Warner Valley Project," (Conservation, Centaur Associates, Inc., 1980) and were summarized from "kWh and Revenue Report, July 1, 1978 through June 30, 1979" (St. George City Utilities Department, 1979). The existing level of peak demand is 32.5 megawatts (MW).

The following projected levels of electrical energy consumption for the years 1980 to 2000 for the city of St. George service area are based upon the assumptions that per capita consumption would remain constant over the 20-year period and that changes in the consumption of electricity would be proportional to changes in the populations of the areas (Conservation, Centaur Associates, Inc., 1980). While the national average indicates a decreasing consumption per capita, there are indications that annual per capita consumption rates in the St. George area are increasing (personal communication, Rudger M. McArthur, Director St. George City Utilities, May 8, 1980). Projected peak demand was computed using a ratio of load growth to peak demand (Burns and McDonnell, 1977).

<u>Year</u>	<u>Peak Demand (MW)</u>
1985	41.93
1990	48.79
1995	54.91
2000	62.05

Nevada Power Company Service Area

Nevada Power Company makes its own energy demand forecasts as a basis for planning and decision making (Chapter 1, Purpose and Need). BLM, however, contracted Centaur Associates to estimate the energy demand for NPC's service area.

As with the St. George service area, the existing (1979) level of electrical energy demand for NPC's service area is taken from "Energy Conservation Alternative for the Allen-Warner Valley Project" (Conservation, Centaur Associates Inc., 1980). The peak electrical demand for 1979 was 1,315 MW.

The following projected levels of peak demand in the NPC service area for the years 1980 to 2000 are based upon the assumptions that per capita consumption would remain constant over the 20-year period and that changes in the consumption of electricity would be proportional to changes in the populations of the areas. There are indications, however, that annual per capita consumption rates in the NPC service area are decreasing (personal communication, John Arlidge, Assistant to the Vice President, NPC, May 8, 1980). Thus, the projections are considered conservative. Projected peak demand was computed using a ratio of load growth to peak demand (Burns and McDonnell, 1977).

<u>Year</u>	<u>Peak Demand (MW)</u>
1980	1,375.8
1985	1,677.6
1990	2,045.9
1995	2,281.5
2000	2,583.0

Pacific Gas and Electric Company and Southern California Edison Service Areas

In California, forecasts of peak energy demand are made by PG&E and SCE for their respective service areas. Forecasts are also prepared by the

California Energy Commission (CEC) in its duties to provide the Governor, the Legislature, and the public of the State of California with the basis for energy policy making. The utilities periodically prepare resource plans for their respective service areas based on their own energy need projections and proposed methods for meeting these energy needs. The CEC prepares a similar document (the Biennial Report) which it uses to meet its planning requirements in providing a direction for energy policy and future energy sources mix.

Overall, the CEC's methodology appears to be a better tool for estimating future demand than the utility methodology. In addition, the disparities in utility and CEC assumptions about future trends in energy prices and conservation impacts in particular make the CEC forecasts more credible. For these reasons, the California Public Utilities Commission (CPUC) is using the CEC forecasts in its assessment of projected electrical energy needs for PG&E and SCE (personal communication, Ron Knecht, Allen-Warner Valley Project Manager, CPUC, May 9, 1980).

The existing and projected peak demand (measured in megawatts) as forecasted by CPUC (based on CEC forecasts) for the respective California utilities from 1980 to 2000 is presented in table 3-2 and 3-3.

Need for Additional Capacity by 1991

In its 1979 Biennial Report, CEC indicated the probable capacity additions that will be needed to meet projected demand in each utility's service (planning) area through 1991. It calculated the amount of new capacity, or its equivalent, that would be needed for each of four reasons:

1. To meet new demand due to growth, as indicated by the adopted CEC forecasts;
2. To replace existing facilities which will probably be retired during this period;
3. To make up for expected losses of out-of-State power purchases; and
4. To meet a State policy goal of a 50-percent reduction in oil and gas use in California powerplants by 1991.

The following table outlines the total capacity additions which would be needed in the PG&E and SCE generation systems for these reasons. To assure a realistic projection, the PG&E service area is assumed to include the Sacramento Municipal Utility District (SMUD).

Projected Capacity Needs by 1991 (MW)

<u>Utility</u>	<u>Demand Growth</u>	<u>Oil & Gas Displacement</u>	<u>Generation Retirement</u>	<u>Lost Purchases</u>	<u>Total Capacity Needed</u>
PG&E (With SMUD)	3,781	2,418	300	512	7,011
SCE	2,500	2,834	400	641	6,375

TABLE 3-2

Demand Forecast for PG&E Service Area, 1980-2000

Year	CEC PG&E Forecast ^a	CEC SMUD ^b Forecast	CEC DWR ^c Forecast	CEC Cogeneration Adjustment ^d	Inter- ruptible Load ^e	PG&E Area Forecast
1980	14,375	1,662	391	11	26	15,609
1985	15,218	1,862	604	75	26	16,375
1990	16,753	2,088	744	75	26	17,996
1991	17,045	2,139	772	75	26	18,311
2000	19,485	2,491	^f 1,024	75	26	20,851

Source: Draft Environmental Impact Report, CPUC, 1980; "Summary Report of the Allen-Warner Project Team: A Planning Strategy for Electric Supply for PG&E and SCE," CPUC, 1980

^aCEC's PG&E forecast includes the self-generated loads of MID and TID (168 MW/year; hence MID and TID supplies are added to PG&E area supplies.

^bCEC's PG&E forecast excludes SMUD service area. SMUD was added in for comprehensive area planning.

^cCEC's PG&E forecast includes portion of DWR demand. This is subtracted since DWR plans independently and on a statewide basis.

^dCEC's PG&E forecast includes reduction for small cogeneration; since this was counted on the supply side, this cogeneration must be added back to demand side.

^ePG&E's current interruptible load is 26 MW, and the utility states that this is not likely to increase since some interruptible contracts have been dropped by customers in recent years.

^fInferred by CPUC staff from other CEC figures.

NOTE: CEC = California Energy Commission; PG&E = Pacific Gas and Electric Company; SMUD = Sacramento Municipal Utility District; DWR = California Department of Water Resources; MID = Modesto Irrigation District; TID = Turlock Irrigation District

TABLE 3-3

Demand Forecast for SCE Service Area, 1980-2000

Year	CEC SCE Forecast	CEC DWR Forecast ^a	CEC Cogeneration Adjustment ^b	Interruptible Load ^c	SCE Area Forecast
1980	12,937	182	62	76	12,741
1985	13,525	131	66	119	13,341
1990	14,880	167	66	119	14,660
1991	15,143	174	66	119	14,916
2000	16,978	^d 237	66	^d 123	16,684

Source: Draft Environmental Impact Report, CPUC, 1980; "Summary Report of the Allen-Warner Project Team: A Planning Strategy for Electric Supply for PG&E and SCE," CPUC, 1980

^aCEC's SCE forecast includes portion of DWR demand. This is subtracted since DWR plans independently and on a statewide basis.

^bCEC's SCE forecast includes reduction for small cogeneration; since this is counted on the supply side, this cogeneration must be added back to demand side.

^cSCE estimate.

^dInferred by CPUC staff from other figures in the series.

NOTE: CEC = California Energy Commission; SCE = Southern California Edison Company; DWR = California Department of Water Resources

Existing and Projected Electrical Energy Sources Mix

A varied mix of sources is used by each of the utilities to meet existing electrical energy demand in their respective service areas. The utilities also project the energy sources mix that they plan to develop in order to meet the future energy needs specified in their demand forecasts. The existing and projected energy sources mix for each of the utilities is presented below. Also described are conservation and load management.

City of St. George Service Area

The area served by St. George Utilities receives 80 to 90 percent of its total electrical energy consumed from a hydroelectric source - the Colorado River Storage Project of the Water and Power Resources Service (formerly Bureau of Reclamation). The remaining 10 percent is either purchased from Utah Power and Light (UP&L), which is primarily generated by coal-fired generators in the central Utah area, or is furnished by a diesel-fired generator owned by the city of St. George. For economic reasons, energy supplied from UP&L is favored over running the city's own generator.

Existing (1979) electrical energy generation capacity and the sources in the city of St. George are summarized below. All sources are firm.

	<u>Hydro- electric</u>	<u>Gas/Oil</u>	<u>Purchases</u>	<u>Total</u>
Megawatts	^a 24	6.8	14.2	45
Load Type	Base	Peaking	Peaking	

^a24 MW are supplied in the winter and 18 MW are supplied in the summer.

St. George City Utilities does not have a formalized energy conservation program for its customers. Periodic addresses are made each year by a utility spokesperson to various citizens' groups, local schools, etc. advising them on ways to conserve energy. Though such programs as mail-in energy audits and information packets have recently been made available by the Utah State Energy Office, there has not been enough time to disseminate this program to the citizens of St. George, nor has a satellite office been established in the area.

Nevada Power Company Service Area

Around 90 percent of NPC's total electrical energy consumed is supplied by coal-fired generation. Most of the company's peaking capacity is supplied through gas or oil-fired generation.

Existing electrical energy generating capacity (1979) and energy sources of the NPC service area are summarized below. All sources are firm.

	<u>Hydro- electric</u>	<u>Coal</u>	<u>Gas/Oil</u>	<u>Purchases</u>	<u>Total</u>
Megawatts	100	807	553	113	1,573
Load Type	Inter- mediate	Base	Peaking, intermediate	Peaking, base	

NPC has engaged in an ongoing energy conservation program. An Energy Management Services department has been staffed and is responsible for performing energy audits, encouraging power consumers to upgrade the insulation in their homes, providing speakers to local groups on energy-related topics, distributing some conservation literature, etc. NPC has initiated a program of selling insulation blankets for water heaters to the public, and sponsors several media advertising campaigns each year on energy conservation and related topics. Other more active conservation efforts in which the company has engaged have been pilot load management projects in which a limited number of customers' air conditioners are switched off for selected lengths of time by remote control during periods of peak demand.

PG&E and SCE Service Areas

The California utilities utilize a varied mix of energy sources to meet the demand for electricity in their service areas. The current generating capacity and that projected for 1991 of each of the energy sources in this mix are presented in tables 3-4 and 3-5 for PG&E and SCE respectively.

A program of both mandatory and utility initiated conservation and load management practices is included in each of the utilities' resource plans. PG&E's current conservation and load management programs include: weatherization of single family homes, energy awareness programs, solar heating and cooling systems, industrial and commercial energy audits, and voltage regulation programs. In addition, PG&E is doing research to find new and cost-effective methods of conservation and load management and has identified several areas of potential energy savings including: no-interest loans for retrofitting insulation or the installment of solar energy technology, passive solar technology, integrated appliance technologies, heat pump applications, waste heat recovery, and lighting efficiency. SCE's current conservation and load management practices include residential and non-residential measures, public awareness programs, streetlight conversion, industrial and commercial energy audits, and voltage reductions. SCE is also researching to find new methods of conservation and load management practices (SCE and PG&E, 1979).

SCE has recently announced a new corporate policy to accelerate the development of renewable (alternative) energy sources (SCE Press Release, October 17, 1980). Table 3-6 presents the firm capacity represented in this new policy. However, this capacity is not represented in the most recent utility resource plan (table 3-5) because it has not yet been officially transmitted to the California Energy Commission as part of the SCE resource plan (personal communication, S.P. Barrett, Senior Engineer for SCE, October 21, 1980).

Existing Legislation and Incentives Favoring Conservation and the Development of Alternative Energy Sources

There are a number of Federal and State laws, tax credits, low interest loans, building codes, etc. which are designed as mandates or incentives to conserve energy and develop nonconventional energy sources. Federal and State legislation and incentives which apply in each of the utilities' service areas are described below.

TABLE 3-4

PG&E Service Area Existing and Projected
Electrical Energy Sources Mix (Firm Capacity - Megawatts)

Source	Capacity (MW)		Capacity Change (MW) 1980-1991
	1980	^a 1991	
Oil and Gas	7,712	7,464	-248
Cogeneration ^b , Solid Waste, and Biomass	188	1,240	1,052
Geothermal	908	2,159	1,251
Nuclear	875	3,128	2,253
Purchases (Pacific NW)	1,400	1,275	-125
Hydroelectric (Adverse Year)	5,335	6,553	1,218
Coal	0	2,645	2,645
Wind ^c	<u>0</u>	<u>48</u>	<u>48</u>
Area Total	16,418	24,512	8,094

Source: Proponents' Environmental Assessment, SCE and PG&E, 1979, as modified in the testimony of R. Bryce Williams, Senior Engineer for PG&E, CPUC Hearings for Certificate of Public Convenience and Necessity, July 1980

^aResource plan projections to July 1, 1991.

^bInstalled capacity of cogeneration is assumed as firm.

^cInstalled capacity of wind energy sources is 143 MW (PG&E does not consider wind energy sources as firm capacity, but these sources are considered firm in this analysis).

TABLE 3-5

SCE Service Area Existing and Projected
Electrical Energy Sources Mix (Firm Capacity - Megawatts)

Source	Capacity (MW)		Capacity Change (MW) 1980-1991
	1980	^a 1991	
Oil and Gas	10,354	9,897	-457
Coal	1,631	2,820	^b 1,189
Nuclear	349	2,671	2,322
Geothermal	0	166	166
Hydroelectric (Adverse Year)	875	929	54
Purchases	2,283	3,887	^c 1,604
Fuel Cells	0	26	26
Cogeneration, Solid Wastes, and Biomass ^d	36	354	318
Wind ^e	<u>0</u>	<u>63</u>	<u>63</u>
Area Total	15,504	20,577	5,073

Source: Proponents' Environmental Assessment, SCE and PG&E, 1979, as modified in the testimony of S.P. Barrett, Senior Engineer for SCE, CPUC Hearings for Certificate of Public Convenience and Necessity, July 1980

^aResource plan projections to July 1, 1991.

^b33 MW of Cal Coal and 119 MW of lay-off power from the Harry Allen power-plant have been accounted for in the Purchases column.

^cIncludes derate for adverse year for hydroelectric purchases.

^dInstalled capacity of cogeneration is assumed as firm (SCE considers firm capacity as 0.33 percent of installed capacity).

^eInstalled capacity of wind energy sources is 189 MW.

TABLE 3-6

SCE Service Area Projected Capacity of
Renewable Energy Sources by 1990 (Firm Capacity - Megawatts)

Source	Additional Capacity by 1990 (MW)
Geothermal	420
Hydroelectric (average year)	620
Fuel cells	130
Cogeneration	300
Wind	120
Solar (photovoltaics and thermal-electric)	310

Source: SCE Press Release, October 17, 1980

NOTE: The capacity represented under each energy source would be added to that represented in table 3-5 for the year 1980 to compute the total capacity for each energy source for 1990. Some of the capacity represented in this table is already included in the resource plan represented in table 3-5. Acceleration of these alternative energy sources would produce an additional 1,000 MW of firm capacity by 1990 over and above that included in SCE's current (July 1980) resource plan included in table 3-5 (personal communication, S.P. Barrett, Senior Engineer for SCE, October 21, 1980).

Federal Legislation and Incentives

In 1978 Congress enacted the five-part National Energy Act. The Powerplant and Industrial Fuel Use Act is intended to halt the construction of new powerplants dependent on oil and gas, and to phase out the use of gas as a utility fuel by 1990. President Carter has proposed amending this law to require that by 1990, the use of oil is cut in half, compared to the recent past use. The other four acts contain several measures that will help to accelerate the development of alternative energy sources and improve energy efficiency:

The National Energy Conservation Policy Act mandates the utilities to provide residential customers with energy audits to identify applicable conservation and solar measures, and provide contracting and financial assistance for their implementation. The Act extends the existing program of weatherization grants to low-income homes, and creates loan programs for conservation and solar energy. It also sets up a program of grant assistance for improving the energy efficiency of schools and hospitals, and for auditing local public buildings.

The Energy Tax Act authorizes tax credits of 15 percent of cost (up to \$300) of installing insulation, caulking, and other energy conservation materials. Additionally, there are credits for renewable energy source equipment such as geothermal, wind energy systems, and solar heating systems. Homeowners may take a 30-percent credit on the first \$2,000 invested and a 20-percent credit for the next \$8,000 up to a maximum of \$2,200. The Act also provides tax incentives for industry to develop geothermal energy and produce geopressured natural gas, as well as business tax credits for conservation and alternative energy use equipment.

The Natural Gas Policy Act incorporates the previously uncontrolled intrastate gas markets into the controlled interstate market, and provides for phased deregulation of the price of new gas supplies by 1985. Gas from certain high price sources will be decontrolled earlier, and the Act has provisions requiring those incremental costs to be passed on only to large industrial and utility users, while maintaining a controlled price for residential and commercial users.

The Public Utility Regulatory Policies Act requires state regulatory bodies and publicly owned utilities to consider 11 voluntary rate design standards--including time-of-day, seasonal, interruptible, and lifeline rates, the prohibition of declining block rates, and the consideration of cost-of-service pricing. The Act also establishes a loan program to aid development of small hydroelectric facilities, and authorizes Federal rules requiring utilities to buy or sell electricity at just and reasonable rates from qualified industrial cogeneration facilities and from individuals or organizations employing nonconventional energy sources that use wind and geothermal technologies.

A number of initiatives currently under discussion in Congress would go well beyond the provisions of the 1978 Acts. The most important of these actions hinge on passage of a "windfall profits" tax on the increased revenues resulting from decontrol of domestic oil production. This tax would provide revenues to fund a substantial program for developing derived fuels and to underwrite additional conservation and solar incentives. Some of the tax revenues would also assist lower income families in meeting their energy needs (California's Energy Challenge: The Next 20 Years, Staff Draft, CEC, 1979).

State of Utah (City of St. George Service Area)

Utah Tax Credit. On January 30, 1980 the Utah State tax credit program became law. The program allows a 10-percent credit on active or passive solar systems, wind systems, and hydroelectric systems, up to a maximum of \$1,000 for homeowners and \$3,000 for owners of commercial establishments. The law is retroactive to July 1, 1977 and will expire if not renewed on July 1, 1985.

Utah Energy Code. On January 1, 1978 the State of Utah adopted an energy code to establish minimum standards of construction to address the problem of energy conservation. The intent of the code is to regulate the design of building envelopes for adequate thermal resistance, low air leakage, and selection of efficient mechanical, electrical, and lighting systems. The goal of the code is the effective use of energy in new building construction. The code also establishes guidelines and requirements related to remodeling existing buildings, but excludes mobile homes from compliance.

State of Nevada (Nevada Power Company Service Area)

Nevada Tax Credit. Since 1977 the State of Nevada has offered property tax relief to homeowners who have solar, wind, or geothermal heating and cooling systems. (Nevada has no individual income tax.) The assessed value of a residential property employing such a system is compared with the assessed value without it, and a portion (which varies by tax assessor) of the difference is allowed up to a maximum of \$2,000 as a tax credit.

Nevada Energy Code. Nevada promulgated energy conservation standards for new building construction in January 1978. The code allows compliance to follow any of three paths for design:

1. A systems approach for the entire building and its energy using subsystems which may utilize nondepletable energy sources;
2. A component performance approach for various building elements and mechanical systems; or
3. Specified acceptable practice.

There are no guidelines or requirements to comply with the code for existing buildings undergoing remodeling. Mobile homes are not covered under the code.

State of California (PG&E and SCE Service Areas)

California has led the other States and the nation in its response to the energy problem. The State of California Legislature has established a basic direction for change by declaring it to be State policy:

"To use a range of measures to reduce the wasteful, uneconomic and unnecessary uses of energy, thereby reducing the rate of growth of energy consumption, prudently conserving energy resources, and assuring statewide environmental, public safety, and land use goals; and

To use conservation and alternative energy resources to the maximum extent feasible" (California's Energy Challenge: The Next 20 Years, Staff Draft, CEC, 1979).

The Legislature has enacted among others the following legislation:

- AB 1512 Requires the CEC to establish solar energy equipment standards and prepare information to encourage use of passive solar design features in buildings.
- AB 1558 Increases the solar income tax credit to 55 percent of the acquisition cost of a solar energy system.
- SB 373 Makes loans available to finance solar energy systems in reconstruction of dwellings destroyed by disasters.
- AB 2321 Prohibits vegetation from blocking sunlight access on solar collector surface during daylight hours.
- AB 3247 Requires the CPUC to investigate methods to finance solar energy systems for utility customers.
- AB 2644 Expedites certification of geothermal powerplants.
- AB 2976 Requires the California Energy Commission to implement a State wind program oriented toward testing and demonstrating the most effective wind technology.
- AB 3046 Requires the Energy Commission to conduct a Statewide competition to select outstanding examples of residential architecture that incorporate passive solar and energy-conserving design features.
- AB 3250 A comprehensive "solar rights" bill to require subdivision maps to provide, to the maximum extent feasible, for the future use of passive solar; requires consideration of passive solar design in new subdivisions; and allows the cost of obtaining a solar easement to be deducted as part of the solar tax credit.
- AB 3324 Required Energy Commission to develop a plan for maximum feasible solar implementation in the State by the year 1990.

- AB 3539 Requires the Energy Commission to develop a program to promote and increase the use of energy surveys and to ensure the quality of cost effectiveness of energy surveys to the public.
- AB 3623 Expands and makes more efficient the application of the 55-percent solar tax credit; authorizes a tax credit for wind and allows builders to pass on credit to home buyers.
- SB 1805 Expedites the powerplant siting procedures for geothermal and cogeneration projects.
- SB 2003 Establishes that the Energy Commission's review of an application for certification of a powerplant site and related facility is the functional equivalent of the environmental impact report process.
- AB 524 Eases permit procedures for cogeneration and resource recovery projects.
- AB 900 Authorizes the Energy Commission to make loans to schools, hospitals, public care institutions, and local government for financing energy conservation projects.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED AND ALTERNATIVE ACTIONS

INTRODUCTION

This chapter of the environmental impact statement (EIS) forms the scientific and analytic basis for comparing the proposed and alternative actions. Discussions of the proposed and alternative actions in this chapter include: (1) direct and indirect effects on the environment and their significance; (2) possible conflicts with the objectives of Federal, regional, State, local, and Indian tribe land use plans, policies, and controls for the areas concerned; (3) natural or depletable resource requirements and conservation potential; and (4) energy efficiency.

Impacts to the following environmental elements would be brought about unavoidably through the implementation of any one or parts of Alternatives 1 through 5: climate, fugitive dust, topography and geology, paleontology, minerals development, soils, and commonly occurring vegetation and wildlife. However, these are considered to be of minor concern (Scoping Process, Chapter 1) and are analyzed in less detail than those elements of major concern.

Environmental elements of major concern (Scoping Process, Chapter 1) which require in-depth analysis of impacts are: air quality related values (including visibility), water resources, threatened or endangered animal and plant species, cultural resources (including archaeologic, ethnographic, and historic values), recreation and aesthetic values (including visual impairment), changes in land use, wilderness, and socioeconomics. Significant impacts to these environmental elements are analyzed on a component basis for each of the alternatives later in this chapter.

Some of the impacts of a proposed action may be unavoidably adverse, implying that the standard operating procedures and mitigating measures as described in Chapter 2 cannot be successfully applied to entirely prevent adverse environmental consequences (residual impacts).

There may also be an irreversible/irretrievable commitment of resources through the implementation of certain project components. These are commitments of resources that would be consumed, destroyed, or lost through the construction and operation activities should an alternative be implemented.

The use of resources for the short-term (here considered to be the project life of the proposed or alternative actions [40 years]) are examined for their effects on the maintenance and enhancement of long-term productivity (the period following the life of the project).

ASSUMPTIONS AND ANALYSES GUIDELINES

In the analyses of the alternatives it is assumed that:

1. Impact analyses are centered primarily on the construction and operation of the proposed powerplants, coal transportation systems, and the

electrical transmission systems. Impact analyses for the three coal sources are summarized and referenced from previously published EISs and environmental assessments (Scope of the EIS, Chapter 1). The impact analyses concerning proposed mining in the Alton coal lease area are not based on a mine plan but rather on the most recent comprehensive information provided by the applicants (Environmental Assessment, NPC, 1975). These analyses would be subject to alteration and review should a mining plan be submitted (see Scope of the EIS in Chapter 1).

2. Any one or parts of the proposed actions and/or alternatives could be included in the eventual selection of the preferred alternative; therefore, significant impacts of each alternative are analyzed equally in depth. Because some of the alternative components are identical in size, function, or design, the environmental impacts associated with their construction and/or operation would also be similar or identical. Although the impact analyses may seem redundant for these alternatives and components, it is necessary to present equal and comprehensive analyses as required under the Council on Environmental Quality implementing regulations of the National Environmental Policy Act of 1969 (as amended).

3. The analyses of the impacts are based on the changes that would occur to the affected (existing) environment through the implementation of any one or parts of the proposed alternatives. Analyses include the type, cause, location, duration, and significance of the impacts.

4. Analyses of impacts are limited to the scope as described in Chapter 1, Scope of the EIS.

5. The application of standard operating procedures and their effectiveness (as listed in Appendix 6) is considered inherent throughout the analyses of impacts to the affected environment. Also mitigating measures specific to an alternative and their effectiveness (Appendix 6) are considered inherent throughout the analysis of that specific alternative. Only those actions which would significantly impact the affected environment over and above standard operating procedures and mitigating measures are analyzed.

6. Impacts to State and private lands are not treated separately in the analyses; however, it is assumed that impacts would be similar to those identified on adjacent public lands.

7. Where insufficient data exists, the "worst case" is analyzed.

8. Where project components and/or areas have been previously studied, relative data is summarized, consolidated, or simply referenced to those previously published studies.

9. Energy efficiency, although not an environmental element, is used as a tool in the analysis of the alternatives.

IMPACTS OF MINOR CONCERN

Climate

The impacts of powerplant emissions on local and regional climatic patterns are not known. However, coal-fired powerplants release relatively large quantities of carbon dioxide (CO₂) into the atmosphere. Continued increases of atmospheric CO₂ from high levels of fossil fuel use could raise the average temperature of the earth's surface from the resulting "greenhouse effect" caused by higher atmospheric CO₂ levels. Current scientific understanding of the global carbon cycle and the possibility of CO₂ induced temperature changes is incomplete because of the controversy over the amount of atmospheric CO₂ absorbed by the oceans and the influence of flora on CO₂ levels (EPA, 1980). The effect of CO₂ releases from a single powerplant is even more uncertain, but because of small CO₂ contributions from powerplants compared to atmospheric concentrations, the impact would be expected to be minor.

Fugitive Dust

Almost all surface disturbing activities produce varying amounts of dust, depending upon the soil moisture conditions and the action taking place. While the severity and duration of any potential impact is difficult to project, fugitive dust should not be a significant problem. The one exception would be fugitive dust associated with surface mining activities. Where a significant impact due to mining activities would occur, it is discussed in the appropriate Air Quality sections.

Topography and Geology

Activities of underground and surface mining would permanently alter the local topography in affected mining permit areas. The severity of surface disturbance would depend on the character of the existing topography. Subsidence would occur on undermined lands, causing a change in present surface water runoff and erosion characteristics. The severity of disturbance would depend on the thickness of coal removed, the thickness of overburden, and the method of extraction. Existing topography would be replaced by a series of highwalls and spoil piles during surface mining activities. Disturbed lands would be reclaimed under the provisions of the Surface Mining Control and Reclamation Act of 1977 as administered by the Office of Surface Mining (OSM) and by the U.S. Geological Survey (USGS) (30 CFR, Parts 211 and 700), but highwalls and spoil piles could only be smoothed to acceptable and not pre-existing contours. Residual scars would be left on the landscape from the excavation of borrow materials for construction of powerplants, the water project, the coal slurry pipeline, and electrical transmission lines.

Seismic disturbances would not be expected to reach an intensity that would adversely affect the operation of various alternative components (e.g., powerplants and the water project dam).

Paleontological Resources

Paleontological resources would be unavoidably destroyed or altered in some areas of construction and coal mining. Construction and mining

activities could also have the beneficial impact of uncovering valuable fossils, which would add knowledge to the geology of the affected area.

Minerals Development

With the exception of minerals in Warner Valley, no other known economically locatable or leasable minerals of significance would be precluded from development with the implementation of any one or parts of the alternatives. Oil and gas, if found at the Harry Allen or Warner Valley powerplant sites, could be recovered by directional drilling at some extra expense. Removing lands from mineral location under the general mining laws would have an impact for the 40-year life of the project in Warner Valley, where there has been considerable claim staking for uranium, silver, and copper, but little exploration activity. If prices of these minerals would increase, additional interest could be expected. Should the Warner Valley powerplant or water project be implemented, present claims would have to be settled at fair market prices (U.S. Mining Laws, 43 CFR, Part 3800). After the projects would have completed their usefulness and would be decommissioned, the lands could be reopened for mineral entry.

Soils

A short-term acceleration of soil erosion would be associated with construction and mining activities. The clearing of vegetation, borrowing, and excavating would also result in a loss of soil productivity and increased sedimentation of streams. Soil erosion rates associated with water would increase annual sediment yields to 12 tons per affected acre in southwestern Wyoming (Development of Coal Resources in Southwestern Wyoming [SW], USDI, BLM, 1978); 4.8 to 11.9 tons per acre in central Utah (Development of Coal Resources in Central Utah [CU], USDI, USGS, 1979); 0.9 to 6 tons per acre in the Alton area (Development of Coal Resources in Southern Utah [SU], USDI, USGS, 1979); and 6 tons per acre in the Mojave Desert region (U.S. Department of Agriculture, 1975). Wind erosion rates could reach more than 100 tons per year on exposed soils and spoil piles (CU,USDI,USGS, 1979). Wind erosion would be especially severe in the Mojave Desert region, where vegetation cover is very sparse and established desert pavements and surface crusts (which naturally inhibit wind erosion) would be disturbed during construction activities.

Productivity of soils would increase and sedimentation would decrease as lands would be reclaimed, slopes stabilized, and vegetation re-established. Vegetation should be restored near pre-existing levels and erosion stabilized near natural levels in 9 years in southwestern Wyoming (SW, USDI, BLM, 1978); 3 to 10 years in central Utah and in the Alton area (CU, USDI, USGS, 1979; SU, USDI, USGS, 1979) and within 30 years in the Mojave Desert region (Vasek et al., 1975). Natural regeneration of native species would require a longer period of time to occur, especially in the Mojave Desert region where complete regeneration could require in excess of 100 years due to climatic constraints (Rowlands, 1980).

Vegetation: General

The clearing of common vegetation would occur unavoidably during the construction of any one or parts of the alternatives. Loss of vegetation on

affected lands would result in accelerated erosion of soils and the reduction of wildlife habitat. In especially arid regions such as the Mojave Desert, affected areas would require up to 100 years to recover to pre-existing vegetation densities, even after reclamation and reseeding. To reduce the time required for vegetation re-establishment, seedbed preparation to enhance plant establishment, application of fertilizers, and other methods necessary for plant establishment would be utilized. The amount of vegetation that would be disturbed during construction and mining activities would range from as little as 16,030 acres under Alternative 4, to as much as 36,981 acres under Alternative 1 for the life of the project.

Wildlife: General

Wildlife would generally be affected in two ways: (1) the direct loss of wildlife and wildlife habitat associated with construction and mining activities, and (2) population reduction of local game and nongame species due to an increase in hunting pressure, illegal shooting, and wildlife harassment associated with increases in local human population related to project development. Wildlife populations should recover to pre-existing levels in the long term (after 40 years). Disturbance to wildlife habitat would range from as little as 16,030 acres under Alternative 4, to as much as 36,981 acres under Alternative 1 for the life of the project.

ALTERNATIVE 1: IMPACTS OF MAJOR CONCERN

The implementation of the applicants' proposed action would involve the following major components: coal mining in the Alton coal lease area of southwestern Utah; construction and operation of two pipelines to slurry pulverized coal from the Alton coal preparation plant to the Warner Valley and Harry Allen powerplants; construction and operation of a 500-MW powerplant at the Warner Valley site in southwestern Utah; construction of the Warner Valley water project in conjunction with the powerplant; construction and operation of a 2,000-MW powerplant at the Harry Allen site in Dry Lake, Nevada; and construction of a transmission system to send electricity from the powerplants to the service areas of the city of St. George, Nevada Power Company (NPC), Southern California Edison Company (SCE), and Pacific Gas and Electric Company (PG&E).

Air Quality

It is recognized that high levels of air pollution can affect human health. To prevent the occurrence of injurious pollution levels, the Environmental Protection Agency (EPA) as directed by the Clean Air Act (as amended August 1977) has established the National Ambient Air Quality Standards (NAAQS) for particulate matter (TSP), sulfur dioxide (SO₂), ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), non-methane hydrocarbons, and lead (Pb). Compliance with these standards is designed to protect human health and welfare. EPA has also established the Prevention of Significant Deterioration (PSD) regulations for SO₂ and particulate matter. These standards are more stringent than NAAQS² for TSP and SO₂ and compliance is designed to protect air quality that is presently better² than the NAAQS while providing for moderate, well controlled growth. EPA is also to promulgate visibility regulations by November 15, 1980.

Acid precipitation is another result of releases of CO₂, sulfur, and nitrogen oxides (NO_x) from emission sources, including fossil fuel burning powerplants. The environmental effects of acidic precipitation have been measured in the eastern U.S. where conditions of higher atmospheric loadings of sulfur and NO_x exist, combined with higher humidity and precipitation levels and acidic, poorly buffered soils. Similar effects have not yet been measured in the more arid low humidity southwest, which has lower population and industrial development, and more alkaline, highly buffered soils. In these areas the first significant measurements of acid rain effects will undoubtedly occur in higher elevation alpine areas with heavier snow accumulations and lower vegetative forms such as lichens and mosses which are efficient accumulators, and in soils and lakes already low in pH. Although the contribution to acid precipitation of a single project such as the Allen-Warner Valley (AWV) energy system would be small, it would add to the total cumulative effect which would at some point become significant if uncontrolled.

Before construction could begin on the Harry Allen and Warner Valley powerplants, the proponents must obtain construction permits from the States of Utah and Nevada and PSD permits from EPA Regions VIII and IX. These permits are issued only if the proponents show that all applicable State and Federal air quality standards and regulations (shown in table 4-1) are met. The proponents have not filed complete permit applications with either the States of Nevada or Utah, or the EPA Region IX (EPA, 1979; personal communication, Utah Bureau of Air Quality [BAQ] Feb. 1980; Nevada Department of Environmental Protection [DEP], Feb. 1980; and EPA Region IX, Feb. 1980). EPA Region VIII determined the Warner Valley powerplant application to be complete in October 1978.

The air quality (including visibility) impacts from the AWV energy system on the mandatory Class I areas of Zion and Bryce Canyon National Parks and the Class II areas of the proposed powerplants and mine sites have been analyzed (EPA, 1979; Warner Valley, ERT, 1977; Harry Allen, ERT, 1977; NPC, 1975). Additional analyses of the air quality impacts and visual intrusion studies of the Alton coal mining operation on Bryce Canyon National Park were prepared jointly by the OSM, National Park Service (NPS), Bureau of Land Management (BLM), and EPA, and in a separate study by Utah International Inc. (UII), proponent of the Alton mine. NPS has prepared a report with visual simulations of the estimated visibility impact on Zion National Park that would result from the Warner Valley powerplant (Appendix 12). Plume tracer release studies have been conducted by NPC at both the Harry Allen and Warner Valley plant sites in response to EPA's request for model validation and additional meteorological and plume behavior data as input to the PSD permit review. This data was submitted to EPA in late May 1980. These additional studies have been included in EPA's review of the PSD permit application for approval or denial of the AWV energy system. This final action is required by the Clean Air Act (as amended August 1977). In addition, the Secretary of the Interior has recommended to Congress that the Paiute Primitive Area (Arizona) be designated a Class I area for air quality and visibility protection. In the absence of any action by Congress, the State would have the sole authority for redesignation (Section 164d, Clean Air Act). Therefore, the Paiute Primitive Area has been considered as a potential Class I area in the air quality and visibility impact analyses. It must be emphasized that this area is presently a Class II area, and until (if ever) this area is

TABLE 4-1

State and Federal Air Quality Standards and Regulations
(Expressed in Micrograms Per Cubic Meter)

	Sulfur Dioxide (SO ₂)			Suspended Particulate Matter		Nitrogen Dioxide (NO ₂)
	Annual	24-Hour	3-Hour	Annual	24-Hour	Annual
<u>NATIONAL AMBIENT AIR QUALITY STANDARDS</u>						
Primary ^a	80	365	.....	75	260	100
Secondary ^b	...	...	1,300	60	150	100
Wyoming	60	260	1,300	60	150	100
<u>SIGNIFICANT DETERIORATION</u>						
Class I	2	5	25	5	10	N/A
Class II	20	91	512	19	37	N/A
Class III	40	182	700	37	75	N/A
<u>NEW SOURCE PERFORMANCE STANDARDS</u>						
	1.2 lb SO ₂ per 10 ⁶ Btu heat input and 90-percent scrubber efficiency, except 70-percent control when emissions are less than 0.6 lb SO ₂ per 10 ⁶ Btu heat input.			0.03 lb particulate matter per 10 ⁶ Btu heat input.		If sub-bituminous coal: 0.5 lb NO ₂ per 10 ⁶ Btu heat input. If bituminous coal: 0.6 lb NO ₂ per 10 ⁶ Btu heat input.

^aFor the protection of human health.

^bFor the protection of human welfare (effects on aesthetics, soil, water, vegetation, wildlife, etc.).

NOTE: At present, the Utah and Nevada State air quality standards are the same as the Federal standards.

N/A = not applicable

Btu = British thermal units

lb = pound

redesignated to Class I, Class II increments apply. The results of the available analysis is presented in this EIS. Also, the State of Nevada requested that any analysis consider the Valley of Fire State Park as a potential Class I area (personal communication, Mike Nolan, Governor's Office of Planning Coordination, State of Nevada, January 31, 1980). However, later correspondence from the State of Nevada (Mike Nolan, Governor's Office of Planning Coordination, October 3, 1980) indicated that the Valley of Fire State Park should be considered as a Class II area, which is the case in this final EIS.

Coal Mining in the Alton Coal Lease Area

EPA Region VIII, under an interagency agreement with the Bureau of Land Management (BLM), National Park Service (NPS), and Office of Surface Mining (OSM), performed a modeling analysis to predict particulate impacts from the proposed Alton mine. Environmental Research and Technology (ERT) conducted a similar analysis for Utah International, Inc. (UII). Premodeling meetings were held between BLM, EPA, OSM, NPS, UII, and ERT to discuss proposed mining activities, emission source terms, meteorological input, and effectiveness of mitigating measures for use in the modeling. In addition, potential visibility impacts from the Alton mine were modeled by Systems Applications, Inc. (SAI) for BLM/EPA/OSM/NPS and by ERT for UII.

The results of the air quality and visibility modeling analyses are presented in table 4-2. The analyses were performed for the year 1994 for which mining operations would be the greatest, and for the year 2014, when mining would be closest to Bryce Canyon National Park.

The EPA analysis used the Industrial Source Complex Model (ISC) to predict 24-hour and annual average particulate concentrations near the proposed Alton mine. The results can be put into perspective by comparison with Class I and Class II increments for TSP. However, it must be emphasized that under current PSD regulations, the Alton mine is not subject to PSD review and its required increment analysis. Although the PSD increments do not apply, they have been used in this section as a guide with which to measure the significance of impacts on air quality. The results indicated that annual average concentrations would not exceed Class I increments at Bryce Canyon National Park. Annual Class II increments would be exceeded on small areas (less than 1 kilometer [km] from the lease boundary).

The 24-hour concentrations indicated exceedences of the Class II increment on somewhat more extensive areas outside of the lease boundaries. Model output predicted exceedences of the 24-hour Class I increments at Bryce Canyon National Park, but the model does not consider terrain, and because Bryce Canyon is considerably higher than the mining areas, it is expected that very little, if any particulate matter would reach Bryce Canyon National Park and exceedences of the Class I increment would not actually occur (Joseph, 1980).

ERT performed modeling for UII to consider particulate impacts from the Alton mine. The results indicated that increased concentrations would be below all annual and 24-hour Class I and Class II increments. The results differ from EPA's results in that EPA predicted annual and 24-hour concentrations in some areas to exceed Class II increments. These differences were

TABLE 4-2

Estimated Air Quality Impacts from Particulate Matter
from the Alton Coal Mine

PSD Increment	EPA/BLM/NPS/OSM Study		ERT/UII Study	
	1994	2014	1994	2014
<u>Annual Average</u>				
In Park Class I	Would not be exceeded		Would not be exceeded 0.2 µg/m ³	0.3 µg/m ³
Offsite Class II	Localized, exceeded within 1 km downwind 29 µg/m ³ at 2 to 5 km 5 µg/m ³		Would not be exceeded 5 µg/m ³	4 µg/m ³
<u>24 Hour</u>				
In Park Class I	Would not be exceeded		Would not be exceeded 2.7 µg/m ³	3.4 µg/m ³
Offsite Class I	Localized, exceeded (>37 µg/m ³) within 1 to 5 kms		Would not be exceeded 29.1 µg/m ³	29.0 µg/m ³
<u>Visibility</u>				
In Park	Little or no particulate would reach Yovimpa Point.		Not studied	
From Park	Particulate emissions from Alton mine perceptible as whitish-gray clouds or haze layers visible against dark, tree-covered viewing back- ground. Visible plumes would be 0.8 to 1.6 miles (10° to 20°) wide and 100 to 400 feet (0.3° to 0.6°) high. Possibility of ad- verse, though localized, visibility impairment.		Occasional decreases in visual range and contrast would be observed from Yovimpa Point in Bryce Canyon National Park and Lava Point in Zion National Park. However, any change in visibility as a result of the proposed project would be observed less than 1 percent of the time.	

determined to be the result of the manner in which the two models accounted for particulate deposition.

Visibility studies were recently performed for EPA/OSM/BLM/NPS, and for UII to determine potential impacts to Bryce Canyon. The present policy of NPS regarding visibility impairment is to protect the scenic values of Class I areas from any adverse impairment at human levels of perception. The visibility studies were performed in order to address the air quality visibility and visual intrusion impact allegations in a petition to OSM to declare certain lands in the vicinity of Bryce Canyon National Park as unsuitable for coal mining (Environmental Defense Fund et al., 1979). SAI, under contract to EPA, performed a visibility analysis for the proposed Alton mine as viewed from Yovimpa Point in Bryce Canyon National Park. The analysis indicated that localized particulate plumes would cause visibility impairment in the form of whitish gray clouds of haze layers visible against the dark, tree covered background. The visible plume would be 10° to 20° wide (0.8 to 1.6 miles), 0.3° to 0.6° high (125 to 250 feet), and visual range through the plume under neutral and stable conditions would be reduced by 5 to 25 percent, depending primarily on the viewing angle (SAI, 1980). The predicted visual impacts would be expected to occur often, based on the frequent occurrence of neutral conditions with light to moderate winds and stable conditions with light winds (Joseph, 1980).

ERT performed a visibility analysis for UII. This analysis was based on calculations for seven lines of sight from Yovimpa Point and for the line of sight from Lava Point in Zion National Park to Bryce Canyon. The analysis concluded that although occasional decreases in visual range and apparent view contrast would be observed from Yovimpa and Lava Points, in general, any change in visibility resulting from the Alton mine would be observed less than 1 percent of the time (ERT, 1980). Visual range reduction calculations are shown in table 4-3.

NPS has used the results of the EPA/BLM/OSM/NPS study in their recommendations in response to the allegations of the Alton unsuitability petition. They have indicated (based on results of the study) that the presence of a visible plume (plume blight) caused by the cumulative impacts of the mining activities would be witnessed by park visitors. This is of utmost concern to NPS because of the present air quality and associated existing visibility in the area (NPS, draft Southern Utah Petition Evaluation Document [SUPED] Hearing, September 29, 1980).

Studies conducted for coal developments in the western U.S. show that increases in pollution levels of particulate matter, SO_2 , NO_2 , hydrocarbons, CO , and O_3 can be expected from population growth associated with coal mining operations (EPA, 1977). The area around the Alton coal lease area has very good air quality, with the exception of occasionally high windblown dust levels (SU, USDI, USGS, 1979). Based on these two studies, the increases in pollutant levels due to the growth in the Alton area when added to the already low background levels would not be expected to violate the NAAQS.

TABLE 4-3

Estimated Visibility Impacts From Alton Coal Mine

Percent Reduction in Visual Range Occurring 0.03 percent, 1 Percent, 5 Percent, 10 Percent, 20 Percent, and 50 Percent of the Time for Eight Lines of Sight.

	Occurrence of Given Visual Range Reductions (1994)					
	0.03%	1%	5%	10%	20%	50%
1. Yovimpa Point - Fifty-Mile Bench	5.5	2.6	2.1	1.3	0.6	<0.01
2. Yovimpa Point - Navajo Mountain	6.3	3.0	1.8	0.8	0.3	<0.01
3. Yovimpa Point - Paria Plateau	5.1	4.1	2.5	1.8	1.4	0.2
4. Yovimpa Point - Mt. Trumbull	7.7	3.9	3.1	1.9	0.9	0.08
5. Yovimpa Point - Moquith Mountains	6.4	6.0	4.3	3.7	2.1	0.7
6. Yovimpa Point - Black Bench	2.4	2.2	1.8	1.2	0.6	<0.01
7. Yovimpa Point - Target 7 (lease area)	2.2	2.0	1.6	1.0	0.7	<0.01
8. Zion National Park (Lava Point) - Bryce Canyon	5.8	4.3	3.4	1.9	1.4	<0.01

	Occurrence of Given Visual Range Reductions (2014)					
	0.03%	1%	5%	10%	20%	50%
1. Yovimpa Point - Fifty-Mile Bench	4.5	2.1	0.9	0.7	0.1	<0.01
2. Yovimpa Point - Navajo Mountain	3.5	1.6	0.7	0.4	0.2	<0.01
3. Yovimpa Point - Paria Plateau	5.2	1.8	1.1	0.7	0.4	0.06
4. Yovimpa Point - Mt. Trumbull	2.7	1.2	0.9	0.6	0.3	0.02
5. Yovimpa Point - Moquith Mountains	3.5	3.1	2.5	1.6	1.3	0.4
6. Yovimpa Point - Black Bench	7.2	5.4	4.2	1.8	0.6	0.1
7. Yovimpa Point - Target 7 (lease area)	11.7	3.6	1.9	1.1	0.6	0.2
8. Zion National Park (Lava Point) - Bryce Canyon	3.7	3.6	1.0	0.7	0.5	<0.01

Source: ERT for UII, 1980

Construction and Operation of the 2,000-MW Harry Allen and 500-MW Warner Valley Powerplants

There have been five separate air quality modeling analyses performed to estimate the air quality impact of the Warner Valley powerplant on the mandatory Class I area of Zion National Park, the potential Class I area of the Paiute Primitive Area, and Class II areas surrounding the plant. There have been four separate air quality modeling analyses performed to estimate the air quality impacts of the Harry Allen powerplant on the Class II Valley of Fire State Park, the potential Class I area of the Paiute Primitive Area, and on the Class II areas surrounding the plant. These analyses have been done over a period of time and used different meteorological, emissions, and/or dispersion assumptions. Therefore, the concentration estimates from each of these modeling studies differ. There has also been a change in the New Source Performance Standards (NSPS) emission limitations and other air quality constraints as a result of the Clean Air Act (as amended August 1977) since some of the studies were completed. EPA Region VIII has also recently completed a study which defined the Best Available Control Technology (BACT) for the Warner Valley powerplant. In order to give a basis with which to compare the concentration estimates of the individual modeling studies and to bring the studies in line with current legal requirements, the concentration estimates in table 4-4 have been ratioed using the following emissions rates which are consistent with NSPS and application of BACT:

	<u>Harry Allen</u> (tons per day)	<u>Warner Valley</u> (tons per day)
SO ₂	40.80	10.38
Particulate matter	8.16	2.04
NO _x	136.22	34.30

Since the BACT for the Harry Allen powerplant has not been determined, the BACT for the Warner Valley powerplant is assumed to apply to the Harry Allen plant also.

Particulate Matter. As shown in table 4-4, initial studies by EPA Region IX indicate that the Harry Allen powerplant stack emissions would cause the PSD Class II increment for particulate matter to be exceeded.

Studies by Radian (1980) indicate that PSD Class I increments if applied in the Paiute Primitive Area potential Class I area and Class II increments in the Valley of Fire State Park would not be exceeded when considering only the particulate emissions from the Harry Allen or Warner Valley powerplants (noncumulative).

Sulfur Dioxide (SO₂). Initial studies by EPA Region VIII and IX show that emissions of SO₂ from the Harry Allen and Warner Valley powerplants would cause violations of the PSD Class II SO₂ increments (EPA, 1978). In addition, the PSD Class I increment at Zion National Park might be exceeded by the Warner Valley powerplant (table 4-4). These estimates were based on modeling conducted by EPA Regions VIII and IX and ERT using the Valley Model. Tracer release studies were conducted by North American Weather Consultants and Meteorology Research, Inc. for NPC in January 1980 to further evaluate meteorological conditions, plume behavior, and model evaluation around the

TABLE 4-4

Estimated Air Quality Impacts Due to Emissions from the Proposed
2,000-MW Harry Allen and 500-MW Warner Valley Powerplants

Estimated Concentration (µg/m³)						
Sulfur Dioxide (SO₂)			Particulate Matter (TSP)		Nitrogen Oxide (NO _x)	
Annual	24-hour	3-hour	Annual	24-hour	Annual*	
Warner Valley Powerplant						
Class II						
EPA Reg. VIII ^a	NC	120.0	NC	NC	NC	
ERT ^b	7.3	115.0	379.7	1.5	11.6	23.7
Stearns-Rover ^c	1.6	71.2	108.0	0.2	7.2	5.3
State of Utah	14.0	52.0	NC	0.9	3.9	NC
PSD Standard	20.0	91.0	512.0	19.0	37.0	.....
NAAQS Standard	80.0	365.0	1300.0	75 (60)	260 (150)	100.0
Class I						
Zion National Park						
EPA ^a	NC	9.0	NC	NC	NC	NC
ERT ^b	NC	NC	3.2	NC	NC	NC
Stearns-Roger ^c	0.1	5.0	7.7	.01	0.5	0.4
Paute Primitive Area						
Radian ^d	<2.0	<3.8	<15.8	<5.0	<10.0	NC
PSD Standard	2.0	5.0	25.0	5.0	10.0	.....
Harry Allen Powerplant						
Class II						
EPA Reg. IX ^e	44.0	94.0(A)	.....	38.0	101.0	103.5
		347.0(E)	1388.0(E)			
		622.0(F)	2488.0(F)			
EPA Reg. IX ^f	.....	.....	.....	72.0	191.0	74.1
ERT ^g	2.9	21.4	250.9	0.3	1.9	13.6
Bechtel ^c	2.0	92.0	307.0	0.9	9.3	9.8
Valley of Fire State Park						
Radian ^d	2.3	16.6	130.0	0.5	3.3	NC
Class I						
Paute Primitive Area						
Radian ^d	<0.2	<0.2	<1.0	<5.0	<10.0	NC

Sources:

^aEPA Region VIII letter October 23, 1979 from Robert L. Duprey, Director, Air and Hazardous Materials Division to John Arlidge, NPC

^bERT, Analysis for Warner Valley, 1977

^cNPC, 1975

^dStudies for BLM by Radian Corp., 1980

^eModeling summary from EPA Region IX, November 1979, assuming an emission rate of 1.7 tons per hour SO_2 , 0.18 tons per hour TSP, and 190 tons per day NO_x

^fEPA Region IX results adjusted to an emission rate of 1.7 tons per hour SO_2 , 0.34 tons per hour TSP, and 136 tons per day NO_x

^gERT, Analysis for Harry Allen, 1977

NC = not calculated

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

(A) = stability class A, highly unstable

(E) = stability class E, moderately stable

(F) = stability class F, highly stable

NOTE: All concentration estimates (except those noted in e) have been adjusted to reflect an emission rate of 1.7 tons per hour SO_2 , 0.34 tons per hour TSP, 136 tons per day NO_x for Harry Allen, and 0.45 tons per hour SO_2 , 0.09 tons per hour TSP, and 36 tons per day NO_x for Warner Valley.

two powerplants. The results of these studies were presented to EPA Region VIII on May 15 and Region IX on May 19, 1980. Review of the North American Weather Consultant tracer study results by EPA, National Oceanic and Atmospheric Administration, and NPS indicate that protection of air quality in Zion National Park could not be assured. EPA Region VIII reported that about 100 days per year have very strong inversions at plume level, and because no extreme inversions were present during the study, worst case conditions were not observed (Fisher, 1980). Region VIII concluded " . . . the study does not reasonably prove that the Warner Valley generating station will have less than a PSD Class I increment on Zion National Park".

NPS indicated that because only one case studied had wind directions toward Zion National Park, and only 8 days total were studied "the tracer study results contain no data which supports the conclusion that operation of the proposed Warner Valley powerplant will not cause significant air quality impacts on Zion National Park" (Henderson, 1980). EPA's National Environmental Research Center also felt that eight field tests were not a sufficient number to draw any conclusions. EPA's Source Receptor Analysis Branch at Research Triangle Park concluded " . . . we do not believe the study has appropriately demonstrated the effects of stable plume impact on the Class I area."

On September 24, 1980, EPA Region VIII proposed to deny the construction permit for the Warner Valley powerplant. The release indicated that NPC had failed to show the legally required protection for air quality in Zion National Park. A public notice was published on October 2, 1980 (Washington County News, St. George, Utah) citing the proposal to disapprove construction of the Warner Valley powerplant because of anticipated effects of resulting emissions on Zion National Park. The notice will provide opportunity for public comment and public hearings on the proposed decision. A final decision will be made by EPA in November 1980.

EPA Region IX met with NPC in October 1980 to review the Harry Allen powerplant tracer study and model validation studies of NPC. EPA has approved the SAI Complex Terrain Grid Model (CTGM) for assessment of the air quality impacts from the Harry Allen powerplant subject to certain conditions (personal communication, letter from Thomas A. Kremer, Chief Permits Development Section, EPA Region IX, to John Arlidge, NPC, October 10, 1980). NPC will proceed with their modeling study in an attempt to show that Class I and Class II PSD and NAAQS would be protected. NPC will submit these results to EPA along with additional BACT information requested by EPA. A determination of application completeness will be made by EPA within 30 days of submission, and it is possible that a preliminary position on permit approval or denial could be made within this same timeframe.

Studies by Radian (1980) for BLM indicate that the PSD Class I increments in the potential Class I area of the Paiute Primitive Area would not be exceeded by the Harry Allen powerplant. Class II SO₂ increments in the Valley of Fire State Park would not be exceeded by the Harry Allen powerplant. The estimated concentrations are presented in table 4-4.

Nitrogen Oxides (NO_x). Initial studies by EPA Region IX (November 1979) indicate that emissions of NO_x from the Harry Allen powerplant would cause violations of NAAQS (table 4-4). There are no PSD regulations

pertaining to incremental limitations for NO_x at this time, but the impacts on atmospheric discoloration and visibility caused by NO_2 emissions would be regulated in Class I areas. These impacts are discussed in the Visibility section of this chapter.

Ozone (O_3 , Photochemical Oxidants). There has been concern in recent years about O_3 production from powerplants. O_3 concentrations in powerplant plumes have been found to be lower than ambient levels near the point of emission. O_3 concentrations in the plumes increase to approximately ambient levels far downwind.

In urban plumes with higher hydrocarbon concentrations, the O_3 concentrations can increase downwind if the nonmethane hydrocarbon (NMHC) to NO_x ratio is greater than 8 to 1 (Miller, 1978). However, the emission rate ratios of NMHC to NO_x in Clark County is only about 4:1 (personal communication Michael Naylor, Clark County Health District, Air Pollution Control Division, September 17, 1980). The Harry Allen powerplant would decrease that ratio, because it would contribute much more NO_x than NMHC; thus it is unlikely that the NMHC to NO_x ratio would be sufficiently large to enhance O_3 formation. Studies by Radian (1980) concluded that conversion of NO to NO_2 in the plume would decrease O_3 levels in Las Vegas and emissions from the Harry Allen powerplant would not cause violations of the O_3 standard.

Plume Opacity. Federal NSPS for particulate matter (Federal Register, Volume 44, Number 113) specify a limitation of 20-percent plume opacity at the stack exit. Particulate concentrations of fly ash from the stack would be about 0.012 grains per actual cubic foot (0.027 grams per cubic meter) assuming maximum load, worst grade coal, and electrostatic precipitators operating at 99.5-percent efficiency.

Studies conducted for NPC by Stearns-Roger, Inc. and Bechtel Corporation indicate that under normal operating conditions the plumes from the proposed Harry Allen and Warner Valley powerplants would be barely visible at the stack (NPC, 1975). However, during startup operations before the electrostatic precipitators would be able to reach operating efficiency, and during upset conditions, the plume could be highly visible at the stack. These conditions must be reported within 24 hours of occurrence to the appropriate State BAQ.

Trace Elements. The proposed Harry Allen and Warner Valley powerplants would emit a variety of trace elements into the atmosphere during powerplant operation. Pathways by which trace elements are distributed through the environment are complex and poorly defined, and the long-term accumulation of trace elements from powerplants is not well known.

Maximum ground-level concentrations of trace elements for the proposed Harry Allen and Warner Valley powerplants have been calculated. Generally, calculated concentrations would be below measured background levels, and would not be expected to be significant over the life of the project. These calculations, along with estimated emission rates of trace elements, are presented in tables 1, 2, 3, and 4 of Appendix 13.

The U.S. Fish and Wildlife Service (USFWS) biological opinion of 1978 (USDI, USFWS, "Formal Consultation," 1978) specifies a concern about possible

toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed plant site. These requirements are listed in the Standard Operating Procedures section in Appendix 6. BLM lease stipulations would require compliance with State and Federal monitoring requirements.

The State of Nevada Department of Environmental Protection would require monitoring of some trace elements. Beryllium would be monitored for 3 months prior to operation of the Harry Allen powerplant and for 3 months after operations would begin to determine impacts from the plant. Lead must also be monitored. Other pollutants to be monitored are determined on a case-by-case basis, and would probably include cadmium, mercury, copper, sulfates, nitrates, particulates, and SO_2 , which were required for Reid Gardner Unit 4 (personal communication, Hugh Ricci State of Nevada, Department of Environmental Protection, September, 1980).

The recently promulgated PSD regulations (Federal Register August 7, 1980) require that a PSD review include BACT determination and air quality analysis for all pollutants to which the National Emissions Standards for Hazardous Air Pollutants apply, and for NAAQS criteria pollutants, unless emission rates would be below the minimum levels set by EPA. Based on preliminary calculations made for emission rates given in table 3 of Appendix 13, the Harry Allen powerplant would be subject to review for the trace elements lead, asbestos, beryllium, mercury, and fluorides.

Preconstruction monitoring of all pollutants subject to review would be required unless the applicant demonstrates that either existing air pollution in the source impact area or its projected impact in the affected area is below minimum concentrations set by EPA. If measurement methods have not been developed for a pollutant, then modeling of ambient concentrations would be substituted for monitoring. Comparison of concentration modeling results shown in table 3 of Appendix 13 with minimum values shows that the trace elements of lead and beryllium would have to be monitored near the Harry Allen powerplant.

Radioactive Nuclides. Radioactive materials are present in any coal, and certain amounts of radioactive nuclides would be emitted from the stack. Maximum ground level exposure from the Allen and Warner Valley powerplant emissions would fall well below the standards for general public exposure set by the Atomic Energy Commission (now U.S. Department of Energy) (NPC, 1975). The impact of the Harry Allen and Warner Valley powerplants on short-term radioactive nuclide levels would not be considered significant, and the impact over the long-term life of the project is not known.

Condensed Water Plumes. Condensation of water vapor emitted from the powerplant stacks and cooling towers would produce a visible plume for a distance downwind from the plant. The length of the Warner Valley stack plume would exceed 500 feet only 25 percent of the time. The length of the cooling tower plume would exceed 500 feet less than 5 percent of the time. The height of the cooling tower plume would be greater than 500 feet less than 20 percent of the time (NPC, 1975).

The stack plume length from the Harry Allen plant would exceed 400 feet approximately 30 percent of the time. Depending on the number of units in operation, plumes longer than 1 mile could be visible between 1 and 5 percent of the time. Cooling tower plumes longer than 100 feet downwind would occur about 22 percent of the time. Plumes longer than 1,000 feet would occur only about 1 percent of the time. The height of the visible cooling tower plumes would exceed 500 feet less than 20 percent of the time and would exceed 1,000 feet less than 1 percent of the time (NPC, 1975).

Because of the distance from major roads, the direction of the prevailing winds, and the arid environment, impacts to motorists from icing and fogging of highways by the cooling tower plumes from the Harry Allen and Warner Valley powerplants would be minimal.

Secondary Pollutants. Gaseous emissions from coal-fired powerplants are carried by atmospheric transport and undergo chemical transformation to form new pollutants (Wilson, 1976). SO_2 may be converted to sulfate aerosols (particulates) and NO_2 may undergo reactions to form nitrate aerosols. Sulfate and nitrate aerosols may travel hundreds of miles and cause air quality degradation. Both sulfate and nitrate particles tend to be small, between 0.2 and 2 microns in size. In the arid southwest, aerosols of this size may be suspended in the air for days before they are removed by natural processes such as wet or dry deposition on soil or vegetation.

The major impacts from these secondary pollutants would be visibility impairment, which is addressed in the following section.

Visibility. Visibility impacts from powerplant plumes are caused by particulates (fly ash), secondary pollutants (sulfates, nitrates), water vapor, and NO_2 . These impacts are generally in the form of (1) reduction in visual range, and (2) visibility of the plume itself (plume blight).

The significance of a visibility impairment has been defined by EPA as: ". . . impairment which, in the judgement of the administrator, compromises the visibility value of the mandatory Class I area" (EPA proposed visibility regulations, 40 CFR, Part 51). In the case of Class I areas, the Federal Land Manager responsible for the Class I area (in coordination with EPA's PSD permit review) would determine whether the potential visibility impact would be adverse.

A brown haze or yellow atmospheric discoloration has been observed from other coal-fired powerplants. This condition occurs under generally stable atmospheric conditions in the fall and winter or in the early mornings of spring and summer (Cramer et al., 1978). Based on these observations, a similar condition could be expected at the Harry Allen and Warner Valley powerplant sites.

Harry Allen Powerplant. As part of the PSD permit review, EPA Region IX has indicated to NPC that they must submit an analysis of the impairment to visibility that would occur as a result of construction and operation of the Harry Allen powerplant. It is specified that particular attention should be given to potential impacts on Class I areas and other National or State parks, and preserves or monuments located within 100 km of the plant site.

Radian (under contract to BLM; 1980) studied the potential visibility impacts to a viewer looking from the Paiute Primitive Area through the Harry Allen plume to the Mormon Mountains. It has been established that the greater the ambient visual range, the greater will be the visibility impairment from pollution. The results of the Radian study indicate that a yellow-brown atmospheric discoloration would be visible when visual range exceeded about 100 km for stable conditions (E stability) and about 120 km for neutral conditions (D stability). Reduction in apparent view contrast would be perceptible when visual range exceeded about 100 km for stable conditions and about 170 km for neutral conditions.

The plume travel time, under stable conditions, to the point of maximum visibility impact (line of sight from the Paiute Primitive Area to the Mormon Mountains) would be approximately 5.5 hours (Radian, 1980). Upper air data from Las Vegas and Desert Rock, Nevada indicates that occurrences of stable conditions in the plume environment persisting longer than a few hours are infrequent (Holzworth, 1979).

Although perceptible visibility impairment was predicted, the Paiute Primitive Area is presently designated as PSD Class II, with no visibility protection mandated by the Clean Air Act. Were the area to be redesignated to Class I before the issuance of a PSD permit for Harry Allen, BLM (the land manager for the Paiute Primitive Area) would have to determine the significance of the potential impacts.

Radian (1980) studied the potential visibility impacts to a viewer looking from the Buena Vista in the Valley of Fire State Park through the Harry Allen plume to the Mormon Mountains. The results indicate that a yellow-brown plume would be perceptible when visual range would exceed about 40 km during stable conditions, and about 100 km during neutral conditions.

Reduction in apparent view contrast would be perceptible when visual range would exceed about 100 km for stable conditions and 145 km for neutral conditions.

While a yellow-brown atmospheric discoloration could be expected to be visible from the Valley of Fire on frequent occasions, especially during morning hours, the Valley of Fire State Park is presently designated as a PSD Class II area with no visibility protection mandated by the Clean Air Act.

For most of the vistas from the Paiute Primitive Area and Valley of Fire State Park, on those occasions when a plume from the Harry Allen plant would be transported through an observer's field of view, the plume from the existing Reid Gardner powerplant and the Las Vegas urban plume would also be transported through the same area. Under these conditions the plume from the Harry Allen powerplant could intermingle with the urban and Reid Gardner plumes to cause further reductions of visual range (Radian, 1980).

Radian chose not to model the most critical case (that of an observer in the Paiute Primitive Area or Valley of Fire State Park looking along the axis of the powerplant plume) because of the uncertainties of using the Gaussian-based visibility models.

Although not protected by law, visibility in the Las Vegas Valley could be adversely affected if the Harry Allen plume were to be transported into the Las Vegas Valley. Although this potential impact has not been subjected to a critical analysis, based on prevailing wind patterns in the area it would not be expected to occur on frequent occasions.

Warner Valley Powerplant. Radian (1980) studied the potential visibility impacts to a viewer looking from the Paiute Primitive area through the Warner powerplant plume to the Mormon Mountains. The analysis indicated that only during neutral or stable conditions with extremely clear conditions (visual range greater than 260 km) would a discoloration be perceptible. Reduction in apparent view contrast would not be perceptible during neutral conditions, and would be perceptible for stable conditions only if the visual range exceeded 320 km. It should be noted that the most critical case (that of an observer in the Paiute Primitive Area looking down the Warner Valley plume centerline) could not be modeled satisfactorily with a Gaussian-based visibility model.

Under EPA's proposed rulemaking for visibility protection for Federal Class I areas, NPS may, in accordance with "Criteria for Identification of Integral Vistas," identify integral vistas to be afforded visibility protection (Federal Register, May 22, 1980). An integral vista is a vista from a Class I area to a scenic landmark located outside the Class I area and which is considered to be an integral part of the visitor experience to the Class I area. NPS is in the process of identifying integral vistas as defined in the proposed visibility regulations. Final determination of integral vistas is expected soon after promulgation of the regulation.

From telephotometer measurements made from July to November 1979 (EPA/Environmental Monitoring and Support Laboratory letter, 1980) the calculated visual range in Zion National Park exceeded 125 km 95 percent of the time. NPS has sponsored a study of the potential impacts of the proposed Warner Valley powerplant plume on visibility in and around Zion National Park (Williams, Cooper, and Wecksung, 1980). If stable conditions occur, with wind flowing from southwest at low wind speed, it would be possible that the plume from the powerplant may be visible from some points in the park. Two scenes likely to be affected by the Warner Valley plant are shown in figure 4-1.

In order to provide a representation of the potential impacts, simulated photographs were prepared (figs. 4-2 and 4-3). The study describes the results of application of the simulated photograph technique to the case of Warner Valley powerplant impacts on visibility at Zion National Park. The Los Alamos Scientific Laboratory (LASL) visibility system developed by Williams et al. (1979; 1980) was used to model dispersion, atmospheric chemical transformation, and radiative transfer of emissions from the Warner Valley powerplant. The modeling results were then displayed using a computer-simulated photograph technique. The scenes, Observation Point (figs. 4-1, 4-2, and 4-4) and Watchman Point (figs. 4-1, 4-3, and 4-5), are near park headquarters above the Virgin River. Observation Point is elevated with respect to the valley floor and was selected to illustrate potential visibility impairment as seen against local terrain features. Watchman Point is closer to the valley floor and allows visualizing the potential plume against both the horizon and local terrain features. Photographs of each of the scenes were taken to provide base slides for the computer-simulated

photograph technique. In the model simulation, the plume was assumed to rise to a stable layer height sufficient to clear terrain obstacles. In the cases of Observation Point and Watchman Point, light winds were presumed to carry the pollutants in the general direction of the observer. A more detailed discussion of the base photographs, assumed meteorological conditions, observer position, viewing angles, sun angle, powerplant operating conditions, and light scattering properties of the pollutants is given in Appendix 12.

The simulated magnitude of plume blight (under the assumed conditions) which would produce a well defined plume are shown in figures 4-2 and 4-3. Unfortunately there is insufficient data available at the present time to adequately assess the frequency of occurrence or duration of the simulated conditions. That such a case would occur is based on similar observations made during studies at other powerplant sites in the southwest (personal communication, Dr. Michael Williams, Los Alamos Scientific Laboratories, September 1980).

The judgement of adversity of the impact to the park would be made by NPS on the basis of interference with management, protection, preservation, and enjoyment of the values of Zion National Park, including interference with the visitor's visual experience. In making this determination, NPS would take into account such factors as the frequency, extent, time of occurrence, intensity, and duration of the impairment. The determination would be made by NPS in coordination with EPA during completion of the PSD permit review process.

Cumulative Impacts. Emissions from the operation of the Harry Allen powerplant could combine with emissions from the Reid Gardner powerplant located at Moapa, Nevada to cause increased ambient pollutant concentrations. EPA has notified NPC of its intent to approve the addition of a 250-MW fourth unit to the Reid Gardner plant. Addition of this unit will bring this plant within 97 percent of the 24-hour NAAQS for SO₂ and 84 percent of the 24-hour NAAQS for particulate matter. Unit four would also use up 75 percent of the 24-hour Class II PSD increment for SO₂ and 19 percent of the particulate matter increment (letter from EPA to NPC, November 5, 1979). In order to construct the Harry Allen plant, NPC must show compliance with the NAAQS and PSD increments alone and in combination with other sources in the area, i.e., the Reid Gardner plant. EPA Region IX is assessing these as part of their PSD permit review process. Increment consumption by the Harry Allen powerplant could preclude future development in that area.

There are no known developments proposed near the Warner Valley powerplant which would use up part of the PSD increments or otherwise cause violations of the NAAQS to occur when combined with concentrations from the Warner Valley plant. Increment consumption by the Warner Valley powerplant could foreclose future development in that area. It is presently the practice of EPA and the States to allocate the use of the PSD increment on a first-come, first-served basis and the amount of remaining increments available to future development would be determined by EPA or the State during completion of the PSD or construction permit analysis procedures.

Population Growth. The peak construction workforce for the Harry Allen plant would increase population in the Las Vegas area by less than 2



PHOTOGRAPH BY NATIONAL PARK SERVICE

BASELINE PHOTOGRAPH OF VIEW FROM
OBSERVATION POINT, ZION NATIONAL PARK



PHOTOGRAPH BY NATIONAL PARK SERVICE

BASELINE PHOTOGRAPH OF VIEW FROM
WATCHMAN POINT, ZION NATIONAL PARK

FIGURE 4-1



VISUAL SIMULATION BY NATIONAL PARK SERVICE

COMPUTER SIMULATION OF BASELINE PHOTOGRAPH



VISUAL SIMULATION BY NATIONAL PARK SERVICE

COMPUTER SIMULATION OF PLUME FROM WARNER VALLEY

FIGURE 4-2

SIMULATION OF IMPACTS ON VISIBILITY FROM
OBSERVATION POINT, ZION NATIONAL PARK



VISUAL SIMULATION BY NATIONAL PARK SERVICE

COMPUTER SIMULATION OF BASELINE PHOTOGRAPH

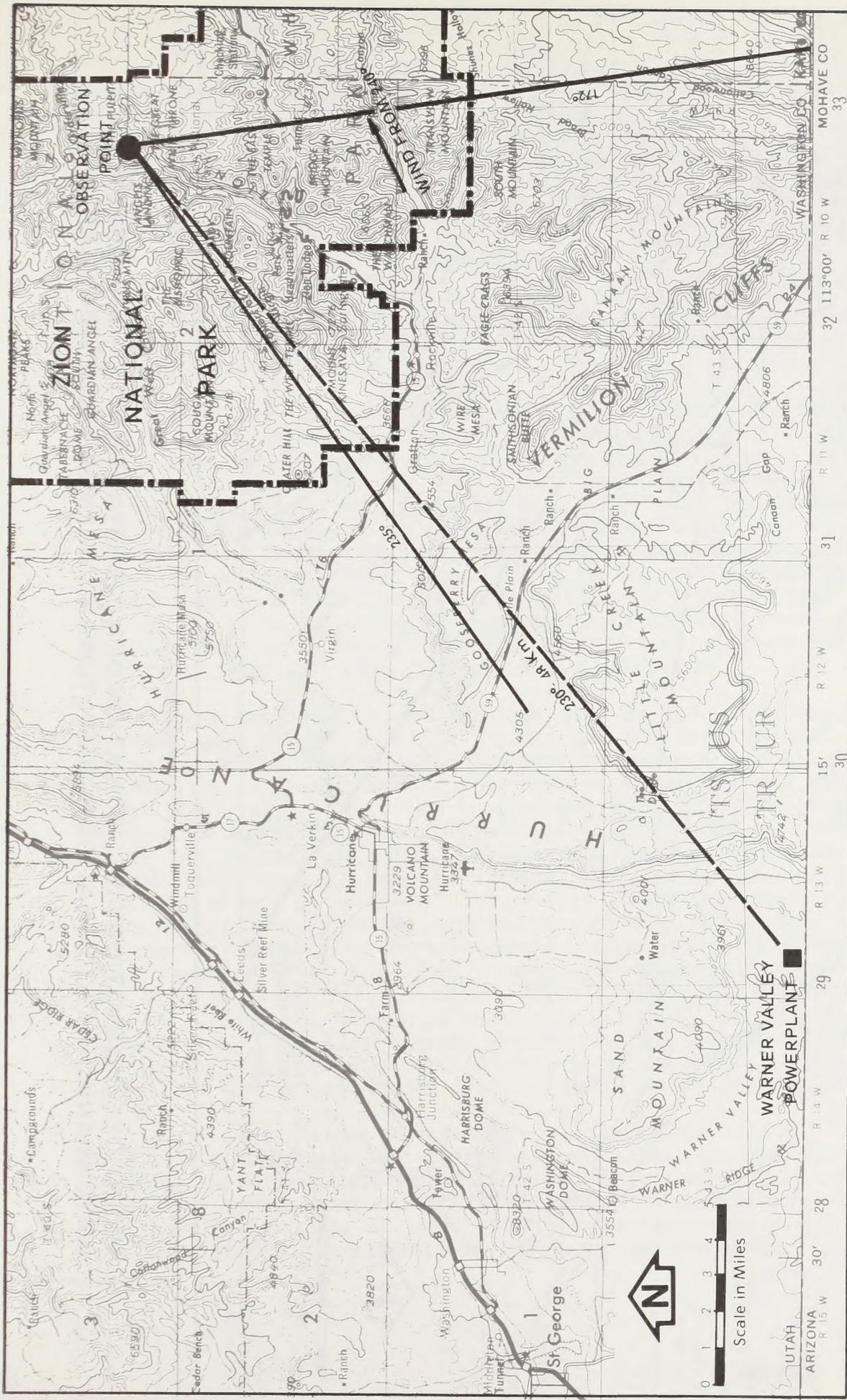


VISUAL SIMULATION BY NATIONAL PARK SERVICE

COMPUTER SIMULATION OF PLUME FROM WARNER VALLEY

FIGURE 4-3

SIMULATION OF IMPACTS ON VISIBILITY FROM
WATCHMAN POINT, ZION NATIONAL PARK

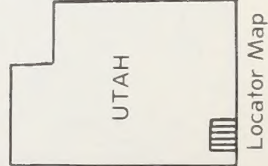


NOTE: Contour Interval 200 Feet

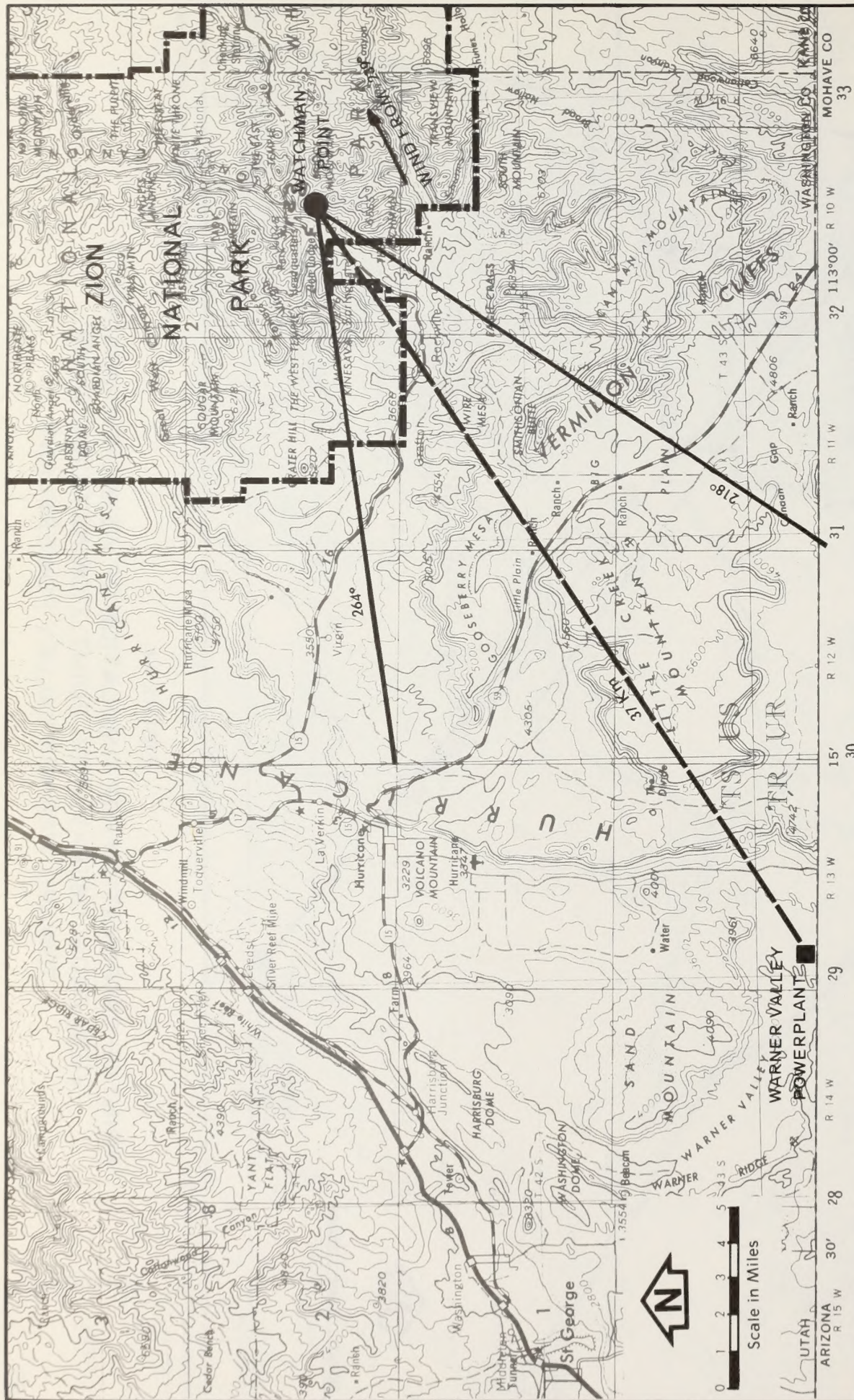
FIGURE 4-4

POINT OF OBSERVATION FOR SIMULATION OF VISIBILITY IMPACTS —
VIEW FROM OBSERVATION POINT, ZION NATIONAL PARK
TOWARD WARNER VALLEY POWERPLANT

SOURCE: NATIONAL PARK SERVICE



Locator Map

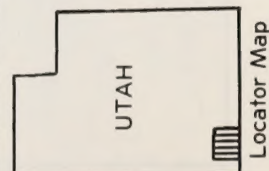


SOURCE: NATIONAL PARK SERVICE

FIGURE 4-5

NOTE: Contour Interval 200 Feet

POINT OF OBSERVATION FOR SIMULATION OF VISIBILITY IMPACTS — VIEW FROM
WATCHMAN POINT, ZION NATIONAL PARK TOWARD WARNER VALLEY POWERPLANT



Locator Map

percent (Socioeconomics, Centaur Associates, Inc., 1980). The air quality impacts from this small population increase would be negligible. The peak construction workforce for the Warner Valley plant would be expected to increase population in Washington County, Utah, by about 8,000 people (33 percent). This population increase would generate increased emissions of air pollutants. However, studies sponsored by EPA (1977) show that the increased emissions from growth of this magnitude would not be expected to violate the NAAQS.

Nonattainment Area of Las Vegas. Violations of the NAAQS for particulate matter, CO, and O₃ have been measured in the Las Vegas Air Quality Maintenance Area. The area has therefore been classified nonattainment for these three pollutants.

Radian (under contract to BLM; 1980) has studied the potential impacts from the Harry Allen powerplant on ambient concentrations of TSP and CO in the Las Vegas nonattainment area and determined that increased concentrations would be less than one-half the values identified by EPA as significant (Federal Register, Volume 45, Number 94). If a new or modified source would cause impacts greater than or equal to these significance levels, it would be subject to nonattainment review. The Radian analysis only considered particulates that would be emitted directly from the Harry Allen powerplant and did not consider impacts due to secondary particulate formation from the conversion of SO₂ to sulfates and NO_x to nitrates. The Clark County Health District has expressed concern that secondary particulate formation may cause significant impacts in the Las Vegas nonattainment area.

A first-approximation analysis was done by BLM to estimate worst-case secondary particulate formation impacts on the nonattainment area. The methodology and calculations for the analysis are presented in Appendix 14. The analysis used modeled annual average and maximum 24-hour concentrations of TSP occurring in Las Vegas from primary particulates. It also assumed conservative values for SO₂ to sulfate and NO_x to nitrate conversion, assumed all NO_x was in the form of NO₂, assumed all nitrates and sulfates consisted of ammonium nitrate and ammonium sulfate, and assumed low wind speed conditions (2.0 meters per second). The results showed that when including secondary particulate formation, the maximum 24-hour TSP impacts to the nonattainment area would not be more than 4.6 µg/m³, which is below the 24-hour significance level of 5.0 µg/m³. Annual TSP impacts to the nonattainment area would be less than 0.3 µg/m³, which is below the annual significance level of 1.0 µg/m³. These calculations should be considered as a first approximation. The Clark County Health District and the State of Nevada Department of Environment Protection have requested NPC to perform a detailed analysis of this matter for the State of Nevada permitting process.

Significance values have not been established for O₃. However, an evaluation of meteorological conditions associated with historically high O₃ episodes, and a comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_x (O₃ precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area, indicate that peak O₃ concentrations would not be increased (Radian, 1980).

Construction and Operation of the Alton Coal Preparation Plant and Pipeline

No significant air quality impacts would be expected from these components.

Water Resources

Major components expected to bring about significant impacts to water resources under this alternative would include: the Alton coal mine and coal preparation facility; a coal slurry pipeline system; the Warner Valley water project; construction of the Harry Allen powerplant; and the diversion of effluent from Las Vegas Wash to the powerplant. Water requirements for mining and coal slurry preparation in the Alton coal lease area would be about 10,000 acre-feet per year, averaged over the life of the project.

Mining in the Alton Coal Lease Area

Surface Water. Surface water related adverse impacts of coal mining would range from water quality degradation and destruction of fish and wildlife habitat to creation of hazards to life and property by increased flood flows.

The potential impacts of surface mining would be increased sediment loads and dissolved solids entering receiving waters due to erosion of mine spoils and disturbed areas where reclamation was started but was not yet complete. Although data on the Alton coal lease area is sparse, that which is available indicates that most streams in the area are intermittent, responding to spring snowmelt and late summer thundershowers, and that sediment loads are relatively high.

Concentrations over 500,000 milligrams per liter (mg/l) a short distance below the proposed Alton surface mine area are reported in EMRIA Report No. 4 (USDI, BLM, 1975). Sandberg (1979) shows that sediment concentrations in streams in the Alton area were as high as 21,200 mg/l and that in Thompson Creek above the proposed mine area, concentrations were never below 45 mg/l. He also states: "Most water flowing through the study [mine] area originates north of the area" and concludes "if the main drainage channels through the mined area are left undisturbed [or routed through or around disturbed areas in protected channels as required by OSM regulations] during mining, the sediment loads and concentrations of dissolved solids during floods or periods of high streamflow would be minimized." If this procedure would be followed successfully, impacts on surface water would derive only from other activities of the surface mine, such as roads or mine facilities. Sediment from mine spoils could be trapped in the highwall pit, in the furrows between spoil piles, or in settling ponds. Sediment so trapped would be buried with the spoil or recovered, if usable, as plant growth material. The supernatant could be pumped to sediment ponds for treatment.

Runoff from partially reclaimed areas could be controlled by mulches, temporary cover crops, and other techniques as required by OSM regulations. Reduced infiltration capacity of reclaimed lands has been noted by Rahn (1976), Lusby and Toy (1976), and others. However, if revegetation would succeed, as is claimed possible by Frischknecht (1980), runoff erosion could be reduced.

According to the SU document (USDI, USGS, 1979), "No reduction of flow owing to strip mining activity [at the Alton mine] is anticipated in the East Fork Virgin River, Kanab Creek, or the Paria River."

OSM regulations (30 CFR, Part 816) require all runoff from disturbed areas to pass through sediment ponds and to be released only when Federal or State water quality standards, whichever is higher, can be met. The regulations require reclamation to begin as soon as possible after disturbance, and also require other necessary measures to minimize or eliminate sediment in runoff. If these practices would be successful, the quality of water discharged could exceed existing stream quality. Impacts of extreme runoff cannot be predicted.

The most notable attempt to evaluate reclamation practices in the west has been completed by Wiener (1980). The conclusions indicate that the success of reclamation methods in the west has not been proven. It must be noted, however, that the sample mines reviewed were in production long before the environmental aspects of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) were obligatory.

Sufficient data does not exist to determine the probability of success of the practices to control mining impacts on surface water since OSM regulations were published in 1979 and experience is not adequate.

Ground Water. Impacts of surface coal mining on ground water in parts of the Alton coal lease area have been discussed in SU (USDI, USGS, 1979), EMRIA Report No. 4 (USDI, BLM, 1975) and the OSM draft SUPED (USDI, 1980). Essentially, these impacts would be those associated with shallow aquifer and spring destruction, potential reduction of deep ground water recharge and discharge, and the discharge of poor quality ground water to better quality surface water.

SU, (USDI, USGS, 1979) indicates that removal and replacement of the overburden during surface mining activities could contaminate ground water from increased leaching of disturbed material. Total dissolved solids (TDS) concentrations could increase two or more times. Sandberg (1979) indicates that characteristics of the shallow aquifers in the Thompson/Skutumpah area are poor and that the replaced material should not significantly change these characteristics. Thus, any modified ground water would probably be restricted to the area of excavation. Goode (1980) indicates that in the Thompson/ Skutumpah Creek area, low quality ground water flow in the affected localized aquifers "is not apt to significantly increase the ground water (baseflow) component in stream discharge." In addition, in the Sink Valley wash area, disrupted aquifers may have good to fair water quality and thus should not degrade present surface water quality. The resulting flow and salinity of the receiving streams would depend on the actual amount and quality of the added ground water, values which cannot be accurately identified for the whole lease area at the present time. Impacts of such a situation are unknown.

Goode (1980) discusses impacts of surface mining on springs in the Alton area and indicates that although 20 springs in the lease area could be destroyed by mining (out of 44 total), impacts from this action would be easily mitigated by requiring the proponent to supply replacement water

(approximately 132 acre-feet per year). Replacement of contaminated, diminished, or interrupted water supplies is required by OSM regulations (30 CFR, Part 816.54).

Aquifers and springs above the coal bearing Dakota Formation should not be affected by mining due to the 650 to 750-foot thickness of the Tropic Shale above the Dakota Formation. In addition, most of those springs are more than 1 mile from the nearest planned mining (SUPED, USDI, OSM, 1980).

A reduction in recharge to the regional Navajo Sandstone aquifer and subsequent reduction in discharge has been analyzed by OSM and BLM in their draft responses to the Alton coal unsuitability petition. In essence, the primary issue here is whether or not water users dependent upon Navajo Sandstone discharges would be affected by recharge reduction in the areas proposed for mining. Cordova (1980) indicates that a significant portion of Navajo Sandstone recharge occurs in the proposed mine area and, therefore, mining could affect the amount of recharge. However, Goode (1980), Sandberg (1979), and UII (1979) believe that the primary recharge area of the Navajo is its outcrop area and that recharge from overlying layers in the proposed mine areas are probably not significant. If this is the case, there would be very little effect on the Navajo Sandstone recharge or discharge due to surface mining.

This latter situation is supported by the argument that if significant recharge to the Navajo was derived from above, then the water quality of the formation would more closely reflect the water quality of the overlying layers. TDS values for the overlying layers (up to several thousand mg/l) greatly exceed the TDS values reported by UII (1979) in the Bald Knoll area (approximately 400 mg/l).

Water needs for the increased population in Kane County (due to mining and support services) have been estimated by OSM (SUPED, USDI, 1980) to be 700 acre-feet annually. These needs would be divided among several communities and would require development of additional water supplies or preempting existing uses. Pumping water from the Navajo Sandstone to meet those needs could amplify impacts discussed in the Ground Water Pumping for Coal Slurry section under this alternative.

Underground Mining

According to the draft SUPED (USDI, OSM, 1980), "Underground mining [in the Alton coal lease] area may drain water from coal beds or saturated beds above the coal if they contain water, which could cause local water-level declines and change the direction of ground water flow near the mine. Cracking associated with subsidence could possibly drain saturated sandstone beds above extracted coal and thereby increase recharge to lower beds; it could also divert surface runoff into the ground. The quantity of water that might be diverted, if any, cannot be predicted, but it could not exceed the average annual runoff from the areas involved and probably would range from 0 to 0.25 of the annual runoff, which is about 20 to 25 acre-feet per square mile. Water so diverted into the ground would not be lost but would add to the ground water storage and would eventually be discharged elsewhere, probably in the same drainage." The extent of these alterations cannot be quantified.

The Surface Mining Control and Reclamation Act of 1977 (PL 95-87) provides guidance and mitigation designed to protect alluvial valley floors in coal mining areas. OSM, in conjunction with BLM, will delineate the alluvial valley floors in the Alton area during investigations which will be used as a basis in the unsuitability determination for the Alton coal lease area.

Ground Water Pumping for Coal Slurry

The applicants propose to obtain water from 13 deep wells up to 2,000 feet in the Navajo Sandstone to be used for the slurry of mined and processed coal. Only six of the wells would be pumped simultaneously at full production, two would be standby, and five would be unused or used as monitoring wells.

The principal issue regarding the proposed Navajo Sandstone ground water withdrawals is not the amount of water available, but whether pumping would affect existing or pending water rights. To determine this, an estimate of the areal extent of the cone of depression due to pumping in the Navajo Formation would have to be made. To accurately determine the extent of water table drawdown, a long-term pumping test using strategically placed observation wells would have to be conducted. No such test has been conducted to date by the applicant.

A computer simulation of the proposed ground water withdrawals was performed by Guisti (1977). This simulation used geologic information from Bald Knoll Well Number 1 and a conservative value of 0.5 foot per day for hydraulic conductivity of the formation. The simulated well field included six wells in a rectangular pattern, 3,000 feet apart. The simulation predicted a several hundred-foot drawdown within a 2-mile radius of the center of the well field after 35 years of pumping 6,000 gallons per minute (gpm). At 5 miles from the center of the well field, a lowering of 30 feet in the water table would occur; and at 10 miles, less than a 1-foot lowering would occur.

The results of the simulation demonstrate only one combination set of possible aquifer characteristics and assumed no recharge. It does not take into account the numerous faults around Bald Knoll as mapped by Goode (1973). If these faults penetrate into the aquifer, hydraulic conductivities could be increased in these directions. Presently there is insufficient information to determine the extent of these faults in the Navajo Formation. If the faults do penetrate the aquifer, it is probable that the influence of pumping would extend much farther in the strike direction (north to south) than across the faults (east to west). This potential effect is especially important because the nearest sources discharging from the Navajo Formation lie in Johnson Canyon and Kanab Creek, south of the proposed well field, and could have reduced discharges (fig. 3-2).

UII performed a limited pumping test on Bald Knoll Well Number 3 during 1978 (UII, 1979). Drawdowns were measured in the pumped well and pumping lasted only 10 hours. The results of the test are inconclusive, but the test did demonstrate that water could be pumped from the formation at a moderate rate (270 gpm), that the quality of the water was very good, and that the aquifer was unconfined in the Bald Knoll area.

Two recent attempts to predict the effects of pumping large quantities of water from the Navajo Sandstone in the Bald Knoll area have been made by Cordova (1980) and Hydrodata (Report to ERT, 1980). Due to insufficient data, both of these reports relied heavily on assumed values for important factors.

Cordova (1980) indicates that increased ground water development in the Alton coal lease area could (1) interfere with existing wells, (2) cause a shift of the natural ground water drainage divide, (3) reduce spring and stream discharge, and (4) possibly change the chemical quality of the water.

Figure 4-6 illustrates distance-drawdown relationships for a well discharging 1,000 gpm for two assumed storage coefficients. The impacts of a well field (six wells) discharging 6,000 gpm, are derived by multiplying the graphically derived value by six. This study is predicated on some controversial assumptions of the aquifer's characteristics. Ground water recharge to the Navajo Sandstone, according to Cordova, is derived primarily from incident precipitation in the outcrop area and through the overlying layers. Several conditions make it difficult to support the latter recharge area. The sequence of sediments overlying the Navajo Sandstone (the Carmel Formation), is composed of relatively impermeable sandstones, siltstones, shales, limestones, and gypsum (UII, 1979). These rock types tend to reduce downward percolation. In addition, water quality measurements from formations above the Navajo Sandstone are significantly more mineralized (up to several thousands mg/l) than the water quality reported from the Navajo Sandstone (less than 400 mg/l). If significant quantities of water were recharging through overlying layers, the water in the Navajo Sandstone would probably be more highly mineralized. Cordova's assumed value for the storage coefficient lacks credibility. Cordova assumes that the Navajo Sandstone in the proposed ground water withdrawal area is a confined system and bases his predicted cones of depression on a confined storage coefficient (2×10^{-3} to 1×10^{-5}). These coefficients are from 0.5 to 0.0001 of the storage coefficients utilized by UII (1979), Hydrodata (1980), and found in his own summary of pumping tests (Cordova, 1980, page 46).

Ground water theory indicates that as the storage coefficient decreases, the affected area (i.e., the width of the cone of depression) increases. Thus the total area affected using Cordova's value would be larger than areas affected using higher (i.e., less confined) storage coefficients.

Hydrodata (Report to ERT, 1980; Report to OSM, 1980) has simulated ground water withdrawals from the Navajo Sandstone from a well field located in Sink Valley Wash and Kanab Creek (approximately 5 miles west of Bald Knoll). The well field was sited at this location due to technical and logistical factors, including depth to ground water, combined cone of depression drawdowns, and modern submersible pump technology (Hydrodata, Report to ERT, 1980). Several simulations were run utilizing several combinations of aquifer parameters (i.e., storage coefficients, transmissivities, leakage factors, etc.). Results of these simulations indicate possible impacts ranging from negligible drawdown to over 100 feet of drawdown in the Alton area and up to 7.9 ft³/s reduction of flow from the East Fork of the Virgin River. A possible area of contention is the low transmissivity values assumed in the simulations (6,000 gallons per day per foot and 10,000 gpd/ft), which would tend to reduce the size of the cone of depression.

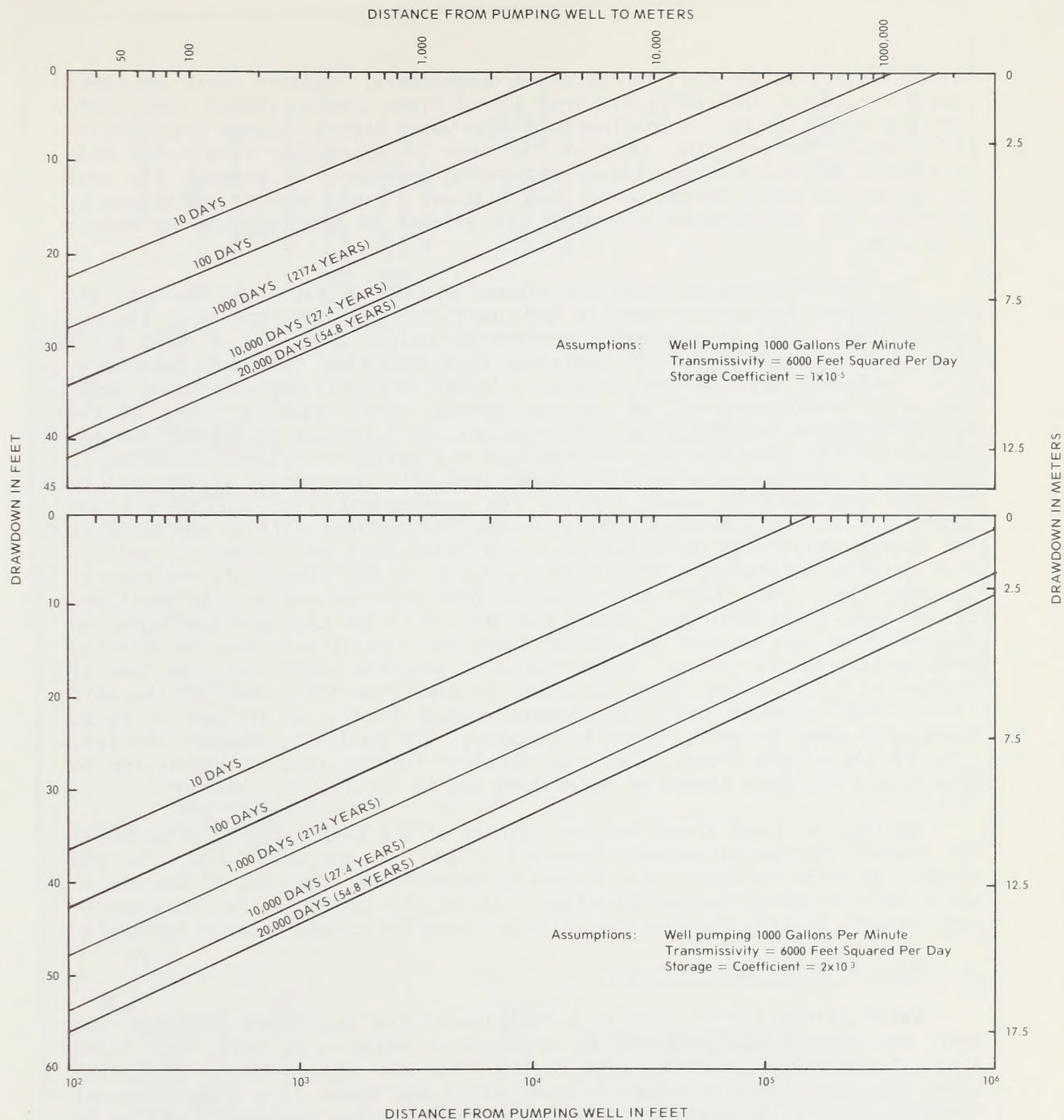


FIGURE 4-6

THEORETICAL RELATION BETWEEN DRAWDOWN AND
DISTANCE FROM A PUMPING WELL IN THE NAVAJO SANDSTONE
FOR SELECTED PUMPING DURATIONS

Transmissivity values utilized by other researchers, (Cordova, 1978 and 1980; Rubenstein, 1966; UII 1979) are from 4 to 9 times greater (SUPED, USDI, OSM, 1980 table III B5-3). According to ground water theory, higher transmissivities would increase the size of the cone of depression (the total area affected), but would reduce the corresponding drawdown. In essence, the cone of depression would become wider and flatter. Thus, results portrayed by Hydrodata may not accurately predict the effects of pumping from the Navajo Sandstone.

The preceding analysis and the unknown effects of faulting, leakage, and other aquifer parameters amplify the need for a long-term, well planned aquifer test. UII is presently performing such a test west of Bald Knoll (fig. 4-7). According to UII spokesman Dave Robertson (personal communication, September 12, 1980 and October 9, 1980) this well and subsequent testing will reveal some of the unknown ground water characteristics of the Navajo Sandstone aquifer. The completed well will produce at least 1,000 gpm and will fully penetrate the thickness of the Navajo Sandstone. Drilling is expected to be completed by mid October 1980 with development of the well to take an additional 2 weeks. After the development, the aquifer will be pumped for at least 30 days. Water level fluctuations will be monitored at the nearby wells (NPC Well Number 1 and Bald Knoll Well Number 1 and 3). Test results and analysis should be available to the Utah State Engineer by January, 1981. This testing program has been approved and will be monitored by the Utah State Engineer. Until the results of the test are available, no determination can be made on whether there would be interference to existing or potential aquifer users. Under the worst possible conditions, the cone of depression could extend 10 to 15 miles or more from the center of the well field. Water tables could be lowered enough to dry up springs or cause additional pumping costs to well operators, and partially dewater the East Fork of the Virgin River. The time required for the cone of depression to extend this distance cannot be determined due to insufficient data.

Springs in Kanab Creek in the vicinity of Big Lake might be affected if the cone of depression extends beyond 9 miles from the well field. For the Kanab city wells in Three Lakes Canyon to be affected, the cone of depression would have to extend beyond 12 miles. It is also possible that no significant impacts to existing users would occur from the ground water withdrawals.

Role of Utah State Engineer

Water allocation in Utah is a function of the Utah State Engineer, who must approve all applications to appropriate water. In 1964, UII filed applications with the Utah State Engineer for the appropriation of ground water in seven areas situated between Alton and Kanab (fig 4-8). Several protests of the applications have been filed with the Engineer's office by area residents, who believe that ground water pumping from these areas would adversely affect their existing water rights.

The Utah State Engineer has indicated that "No action will be taken on Utah International's application until test wells have been drilled and additional long term pumping tests performed. Once the test data has been collected and analyzed, if the State Engineer feels confident that interference with existing water rights will be either very nominal or nonexistent, then all or part of the applications filed by Utah International could be approved" (personal communication, Utah State Engineer, September 17, 1980).

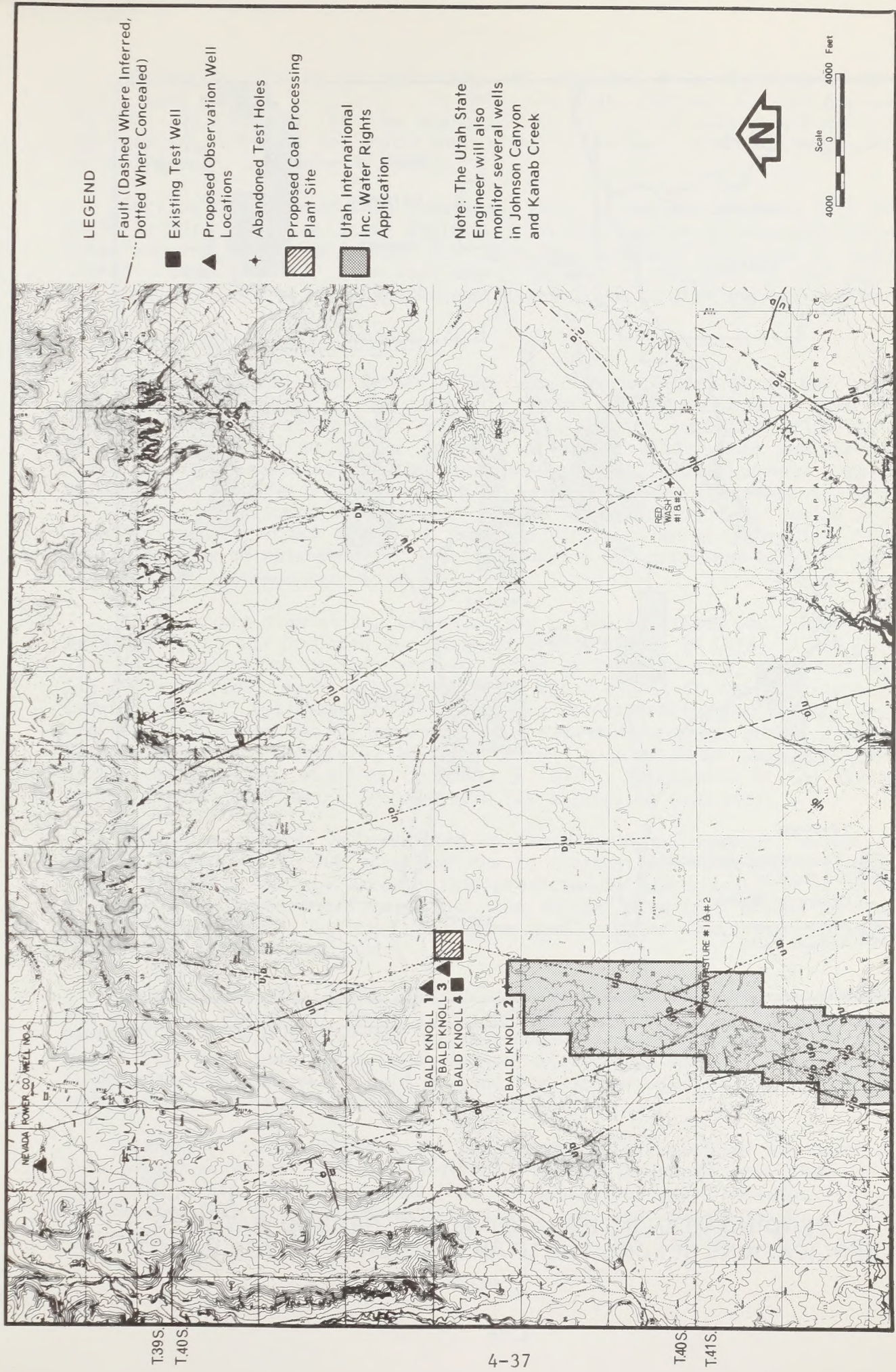


FIGURE 4-7

TEST WELL AND OBSERVATION WELLS IN THE VICINITY OF THE PROPOSED COAL PREPARATION PLANT

NOTE: Contour Interval 100 Feet

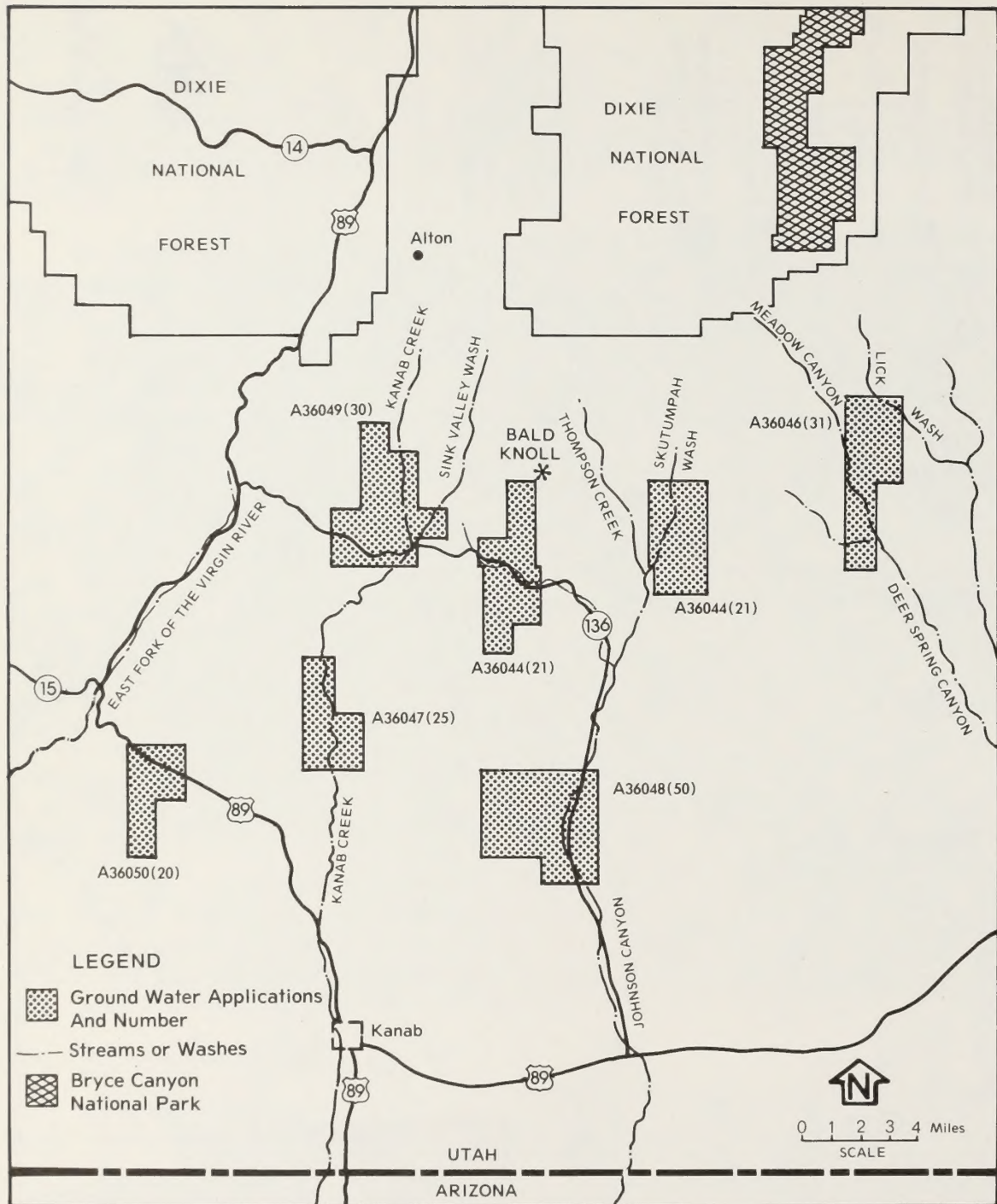


FIGURE 4-8

PENDING UTAH INTERNATIONAL INC. GROUND WATER APPLICATIONS BEFORE THE UTAH DIVISION OF WATER RIGHTS

Presently, UII is concentrating its proposed water development to a single area west of Bald Knoll. To date, the State Engineer has not approved any UII applications for the appropriation of ground water, and existing applications are "in an unapproved status" (personal communication, Utah State Engineer, September 17, 1980).

Section 73.2-8, Utah Code Annotated, 1953, as amended by House Bill 106, 1979, permits the Utah State Engineer with the consent of the Governor to authorize and appropriate water for conveyance and beneficial uses to border states. Under this Act, the Utah State Engineer is required to make public how such an export of water would benefit the State of Utah and its citizens.

Warner Valley Water Project

The analyses of the Warner Valley water project consist of two components: (1) an analysis of the reservoir system and proposed water uses, and (2) an analysis of the effects of diversions and the subsequent flow regime of the Virgin River below the proposed diversion site. Both analyses are based on simulated flows for the years 1940 through 1975 which were prepared by Dr. Norm Stauffer, Utah Division of Water Resources (December 5, 1979). The simulation assumed construction of the Kolob Water Project which would annually transfer 6,500 acre-feet from the Virgin River to Cedar City, Utah. In the absence of this project, the additional 6,500 acre-feet of water could increase the proposed reservoir yield.

Based on the simulation, approximately 56,100 acre-feet would be diverted annually at the proposed Hurricane diversion site. Of this, 37,700 acre-feet would be routed to the proposed Warner Valley reservoir. The remainder (18,400 acre-feet) would satisfy existing water rights in the Hurricane and LaVerkin areas. Estimated annual losses due to evaporation and seepage would reduce the diverted 37,700 acre-feet to a reservoir average annual yield of 32,600 acre-feet. According to the Utah Division of Water Resources (personal communication, Stauffer, December 5, 1979), this would be the average amount of water that would be available for allocation each year.

The actual yields as predicted by the simulation, however, would vary between 16,000 and 63,000 acre-feet due to fluctuations in yearly precipitation. Since the average annual yield predicted by the simulation is 32,600 acre-feet, it appears unlikely that the 49,400 acre-foot annual delivery schedule as proposed by the Washington County Water Conservancy District (table 2-3) would be realized.

According to NPC (1975), the proposed Warner Valley powerplant (500 MW) would use an average of about 5,830 acre-feet per year from the reservoir. However, up to 10,000 acre-feet per year could be used, depending on climatic conditions, coal burn rates, and consumer electricity demand. An additional 8,000 acre-feet per year would be used for supplemental irrigation on presently irrigated land in Washington County.

Therefore, of the 32,600 acre-foot average annual yield of the reservoir, only 14,600 acre-feet would be available to meet potential uses (table 2-3; fig. 2-6). This analysis assumes that the powerplant would consumptively use 10,000 acre-feet of water annually and that the dead storage volume of 5,000 acre-feet would be stored the first year that the available water supply

would exceed the two firm commitments (if the average powerplant requirement of 5,830 acre-feet is used to compute the water supply available for potential uses, an average of 18,770 acre-feet would be available annually).

Reservoir Water Quality and Quantity

Water quality in the proposed Warner Valley reservoir was projected in a study by BLM (Gebhardt, 1977). Average TDS would range between 500 and 600 mg/l depending on evaporation and the influence of the geologic formations underlying the reservoir. Apparently, TDS would be the only chemical parameter exceeding State of Utah recommended drinking water standards. The water would be of poorer quality than the ground water sources from which the city of St. George presently obtains culinary water. According to the State of Utah Department of Social Services, Division of Health (1975), the water from the reservoir would require full treatment before it could be used as a culinary source. This would include flocculation, sedimentation, filtration, and disinfection.

Turbidity levels in the reservoir would be seasonal. Turbidity would be low during summer months, but high during the winter and early spring when the reservoir would receive most of the inflow from the Virgin River. In addition, a combination of the inflow regime, drawdowns of the magnitudes listed above, and local climatic conditions would cause water temperatures and related dissolved gases to fluctuate seasonally. Therefore, recommended temperature and dissolved oxygen limits for warm water fish could be exceeded occasionally and fisheries potential could be limited (Thurston et al., 1979).

Based on 7 years of sediment data collected at the Hurricane gaging station and quantitative analysis procedures used by Vaughn Hansen Associates (Endangered Fish, 1977), approximately 265,000 tons of sediment would be diverted annually under the proposed diversion schedule. Of this, about 20 to 25 percent would be returned to the river by the proposed vortex sediment ejector system (Endangered Fish, Vaughn Hansen Associates, 1977). Of the remaining 212,000 tons, approximately 20 percent would be deposited on irrigated farm lands near Hurricane, and the remaining 170,000 tons would flow into the Warner Valley reservoir. At this rate, the reservoir's 5,000 acre-foot dead storage capacity would be filled in 50 to 60 years. Continued sedimentation beyond this date would reduce usable storage capacity of the reservoir.

Based on the computer simulation, the storage in the reservoir would fall below 20,000 acre-feet about 5 of every 35 years. Storage would fall below 10,000 acre-feet about 1 of every 35 years. These low storage conditions would apparently only occur following 2 or more consecutive years of low flow in the Virgin River (below 90,000 acre-feet per year near Virgin).

A 20,000 acre-foot storage level corresponds to about 60 feet of drawdown from maximum storage, and to a 325-acre surface area, or about 45 percent of the maximum surface area of 750 acres (Bingham Engineering, 1977). These conditions would adversely affect recreation and fisheries potential by occasionally dry docking boat launch ramps, destroying spawning habitat, and creating large mud flats (due to the large amount of fine sediment diverted into the reservoir). Drawdowns are based on the applicants' proposed delivery schedule (table 2-3).

Reservoir Safety

Failure of the proposed Warner Valley dam would result in a flood wave and flow at least as damaging as a standard project flood. This magnitude flood was identified by the Army Corps of Engineers (U.S. Department of Defense, 1973). The flood wave from the reservoir would likely destroy or greatly damage numerous homes in the Bloomington area and would destroy or damage four bridges on the Virgin River above the narrows. A breaching study for the Warner Valley dam, conducted by the Bureau of Reclamation in July 1977 showed that outlet works of the proposed dam would successfully pass a 100-year flood event without overtopping or failure.

New springs may occur on the west side of Warner Ridge as a result of the reservoir. Water could move through the Shinarump member of the Chinle Formation and issue from the Moenkopi Formation (Bingham Engineering, 1977). These springs would discharge on adjacent public lands and would ultimately empty into the Virgin River. The likelihood or extent of the flow of these springs cannot be estimated.

Effects on the Virgin River System

Impacts to the Virgin River system below the diversion will be analyzed by river segments. Table 4-5 lists pre- and postproject median flows based on a computer simulation by Utah Division of Water Resources (Stauffer, February 5, 1980).

Hurricane Diversion to St. George-Washington Fields Canal. Based on the computer simulation, average annual flows bypassing the proposed Hurricane-Warner Valley diversion would be about 61,000 acre-feet. This would reduce the annual flow bypassing the diversion by about 38 percent. Median flows bypassing the diversion would be reduced by more than half during the winter and spring (table 4-5).

Of the 265,000 tons of sediment diverted (yearly average), the desilting works would be expected to return about 53,000 tons of sediment to the river. This sediment would be carried downstream by the remaining 61,000 acre-feet of water passing the diversion. In addition, flows with the highest concentrations of sediment (greater than 20,000 mg/l), would be allowed to pass the new diversion. Consequently, the average annual suspended sediment concentration below the proposed diversion would increase by as much as 80 percent per year (from 11.97 tons to 21.52 tons per acre-foot of water). The net effect of the diversion and desilting works would be to decrease the total load carried by the river by about 6 percent and increase downstream concentrations of suspended sediment perhaps by as much as 80 percent per year. Simons (Endangered Fish, Vaughn Hansen Associates, 1977) indicates that postproject "... sediment could alter the river environment for short periods of time, but a comprehensive analysis of the total problem shows that the impact is trivial, except locally and the impact is only significant during periods of low flow."

CP National Utilities Company presently diverts 40 cubic feet per second (ft³/s) when available at the LaVerkin diversion for hydroelectric power generation for the town of LaVerkin, Utah. The proposed diversions for the water project would not reduce the present 40 ft³/s diverted for the

TABLE 4-5

Median Flows of Virgin River at Selected Sites
(Expressed in Cubic Feet Per Second)

	At Virgin, Utah	Below Hurricane Diversion	Hurricane Gaging Station	Below Washington Fields Diversion	Before Confluence With Santa Clara River	At Littlefield, Arizona
<u>Preproject</u>						
October	110	65	90	20	55	115
November	125	125	140	100	160	170
December	135	135	160	120	190	200
January	135	135	175	135	215	210
February	130	130	175	165	220	205
March	180	180	205	135	240	215
April	200	150	230	95	205	245
May	190	140	190	0	155	170
June	90	40	75	0	45	70
July	85	45	85	5	25	150
August	105	65	110	40	45	150
September	95	55	75	10	25	95
<u>Applicants' Proposal</u>						
October	110	45	75	5	60	^a 120
November	125	60	70	30	85	95
December	135	45	70	30	85	95
January	135	40	85	45	95	90
February	130	40	85	45	95	80
March	180	80	105	65	120	95
April	200	75	125	35	105	145
May	190	70	105	15	95	110
June	90	40	75	1	80	105
July	85	45	85	5	65	190
August	105	40	90	20	60	165
September	95	45	75	10	50	120
<u>USFWS Proposal</u>						
October	110	45	75	5	55	^a 115
November	125	100	110	70	120	130
December	135	85	110	70	120	130
January	135	70	110	70	115	110
February	130	70	110	70	115	100
March	180	100	110	65	120	95
April	200	80	130	75	105	145
May	190	85	125	15	100	115
June	90	40	75	5	65	90
July	85	40	80	5	45	170
August	105	40	90	20	45	150
September	95	40	70	10	35	105

Source: Simulations by Dr. Norm Stauffer, Utah Division of Water Resources, 1980.

^aEstimations of Littlefield flows are based on preproject accretions between Bloomington and Littlefield Springs, Arizona.

powerplant, but would preclude CP National plans for expansion of the powerplant use of the present 40 ft³/s diversion to their existing diversion right of 100 ft³/s.

With CP National continuing to divert 40 ft³/s for hydroelectric power generation, and the Warner Valley water project diversion, the river would be expected to be dry from the LaVerkin diversion to LaVerkin Springs about 30 to 40 percent of the time, including some winter and spring months of dryer years. By comparison, preproject, no-flow conditions below the LaVerkin diversion probably occur about 10 to 20 percent of the time of an average flow year and are almost completely restricted to summer months.

LaVerkin Springs, about 2 miles downstream from the LaVerkin powerplant diversion, would add 11 ft³/s yearlong and would consequently be for much of the year the only source of flow 1 mile downstream to the powerplant inflow.

Average water quality would be impaired below LaVerkin Springs because of the decrease in flow available to dilute the highly saline LaVerkin Springs flow. TDS concentrations would range from 900 to 9,600 mg/ℓ yearlong down to the powerplant and would probably average 9,600 mg/ℓ about 30 to 40 percent of the time. At the powerplant return flow, dilution by 40 ft³/s would reduce the annual average to about 1,550 mg/ℓ, an increase of about 400 mg/ℓ over preproject conditions.

Between the LaVerkin Springs and the Hurricane gaging station, the median inflows from tributaries, agricultural return flows, and ground water would be estimated to be about 20 ft³/s from June to December, and 40 ft³/s from January through May.

The resulting median flows at the postproject Hurricane gaging station would be estimated to range from 70 to 125 ft³/s yearlong, with flows over 100 ft³/s during the spring (table 4-5). Low flows during summer months would not be changed significantly since additional water would not be diverted at the proposed Hurricane-Warner Valley diversion under these conditions.

Based on the available data, it appears that average salinities near the Hurricane gaging station would increase approximately 175 mg/ℓ annually, from 1,150 to 1,325 mg/ℓ. Salinity is inversely related to flows; generally the higher the flow the lower the salinity because of the effect of flow on dilution of the LaVerkin Springs water (208 Water Quality Study, Vaughn Hansen Associates, 1977). The increase in salinity may cause the remaining flows in the river to be less suitable for irrigation water at the St. George - Washington Fields diversion. However, impacts to these users may be negligible or slight during summer months since high quality reservoir releases would supplement water diversions from the river. The net effect may be an improvement of irrigation water for use in the St. George - Washington Fields areas.

The impact of the increased sediment concentrations on downstream water users would probably be minimal. While the remaining water in the river would be carrying more sediment on the average, concentrations would generally be well below 10,000 mg/ℓ and would not be prohibitive for diversion for agriculture. In addition, the new diversion would probably not increase the

frequency of flows with extremely high concentrations of suspended sediment greater than 20,000 mg/l, which generally would not be diverted for irrigation.

St. George - Washington Fields Diversion To Bloomington. Following construction of the project, nearly all flows from May through October would be diverted at the St. George-Washington Fields diversion. Median flows bypassing this diversion would be reduced by half or more during June through October and reduced by two-thirds from November through May. This assumes that the Washington Fields Canal Company would divert up to 95 ft³/s during the summer and from 40 to 70 ft³/s during the winter and spring.

Flows bypassing the diversion would generally be less than 35 ft³/s most of the year, except for the spring months when flows could exceed 45 ft³/s about half the time.

Flows would increase downstream from ground water influx and irrigation return flows to where postproject flows generally would be expected to be greater than 50 ft³/s year round at Bloomington. The median flow would be expected to increase, and possibly double during the summer months because of increased return flow from reservoir releases. Winter and spring flows, however, would be reduced by about one-half (table 4-5).

Salinity concentrations below the St. George-Washington Fields diversion would be increased further from present irrigation return flows, although specific TDS values are unknown. This effect would be greatest during the summer months. The total flow and water quality of the Virgin River below the diversion are partially attributable to ground water accretions, generally of poor water quality (208 Water Quality Study, Vaughn Hansen Associates, 1977). Whether or not the supplemental irrigation would alter the existing ground water component (quality or quantity) is unknown.

Average annual flow would be expected to be reduced by at least 21,000 acre-feet at Bloomington (table 4-6). This figure is based on the calculations of consumptive use for each of the proposed uses of the water project assuming the following:

1. Reservoir seepage and annual losses of 5,200 acre-feet would not be returned to the river (Stauffer, February 5, 1980).
2. Powerplant consumption would be 10,000 acre-feet per year.
3. Municipal and industrial losses would be about 40 percent of the reservoir water intended for those purposes (5,800 acre-feet). The remainder (8,800 acre-feet) would be returned to the river.
4. Since 8,000 acre-feet of water have been identified for supplemental irrigation needs on existing irrigated acreage, no significant increase in agricultural consumptive use would occur. According to a letter from the Soil Conservation Service (personal communication, Verle Smith, September 23, 1980), supplemental water is needed most years during July and August in the St. George/Washington Fields area. However, specific amounts required are not known. The supplemental irrigation may increase ground water influx into the Virgin River system, but the probability or magnitude

TABLE 4-6

Consumptive Use of Virgin River Water as a
Result of the Warner Valley Water Project

Source of Loss	Acre-Feet
Seepage, evaporation losses from reservoir and new canal	5,200
Powerplant losses	6,000
Municipal and industrial	<u>4,000</u>
Total consumptive use of Virgin River water as a result of the water project	15,200
Water removed from the Virgin River system by Kolob Water Development Project	6,500
Total reduction in flow expected at Bloomington including Kolob Project	21,700

of this situation is unknown. If a significant increase in irrigation would occur, replacing proposed municipal and industrial uses, the total consumptive loss to the Virgin River system could be greater because of the greater consumptive use efficiency of irrigation, approximately 55 percent compared to 40 percent (208 Water Quality Study, Vaughn Hansen Associates, 1977).

Bloomington, Utah To Lake Mead, Nevada. The Virgin River loses an average 51 ft³/s to infiltration above the Virgin River Gorge. If the flow at Bloomington would be less than the infiltration capacity, then no water would enter the gorge and the river would be dry to Littlefield Springs.

Summer flows at Littlefield, Arizona would be augmented with releases from the proposed reservoir and return flow. Median flows may increase by 5 to 40 ft³/s during the summer but may be reduced by 60 to 125 ft³/s from November to May.

If the influent reach is related to the Littlefield Spring, as evidence indicates, then it appears that the loss of recharge to the aquifer during the winter months would be offset by the newly sustained recharge during the summer months (table 4-5). However, the water recharging the aquifer would be of poorer quality than the preproject water as described previously. It is possible that ultimately the TDS concentrations in the Littlefield Springs flow would be increased in proportion to the increase in TDS experienced at the Hurricane gaging station upstream.

The expected increase in salinity would probably range from 300 to 500 mg/ℓ from November through May following construction of the project. Average salinity would be expected to decrease by 15 to 125 mg/ℓ with the increased flow expected during the summer months. These calculations were made assuming that the quality of the water coming from the upper Virgin River would be the same under postproject conditions. However, the salinity of the upper basin water would be increased as described previously due to the reduced flows and increased salinity below LaVerkin Springs, and the increased return flows (irrigation and industrial) below the St. George - Washington Fields diversion. Quantitative effects of the increased salinity on the water quality of the Virgin River near Littlefield are not known, but it is assumed that this factor would increase the projected TDS values for winter, spring, and annual flows. Although this analysis is simplistic and the results are approximate, they do illustrate the effect of decreasing both the quantity and the quality of flows reaching Littlefield during the winter and spring months. Water users below the Virgin River Gorge should not be significantly affected by the altered flow regime and water quality. Since only good quality snowmelt and peak flows are used for leaching during the spring in this area, and these flows would continue to pass the upstream diversions, no change from the present situation would be expected. In addition, when lower quality winter flows would be diverted, they would be used primarily to sluice sediment out of canals. Additional water could be available during summer months due to increased irrigation return flow below the St. George - Washington Fields diversion. Primary crops grown in this region are alfalfa, grain, and some silage (personal communication, Dee Hughes, former President of Mesquite Canal Company, January 23, 1980).

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant would require diversion dikes along two washes within the plant site, around the settling and storage ponds, and a flood control structure to protect the old highway frontage road. These structures and the reduction of 1,850 acres of playa (20 percent) for the plant site would combine to raise the surface water elevation of a potential 50-year flood to the 1,985-foot contour line, approximately 8.5 feet higher than what would be expected under present conditions. This would result in increased maintenance problems for the existing transmission lines (located at the eastern edge of the playa), which would be standing in 15 feet of water. Flood waters would stand for a longer period of time, thus increasing flood duration and compounding related impacts. Flooding of the old highway frontage road (and access to the town of Dry Lake) should be avoided with the construction of the proposed flood control structures.

The Harry Allen powerplant at Dry Lake, Nevada would require an average 24.5 million gallons per day (mgd) of effluent from the Clark County Advanced Wastewater Treatment (AWT) Plant for cooling purposes when the powerplant would reach full production capacity. Under peak load basis, up to 48 mgd could be required. However, impacts of the 24.5 mgd effluent transfer to the Allen plant instead of Las Vegas Wash would be minimal, since growth in Clark County is expected to contribute an additional 30 mgd of new effluent by the mid-1990s (personal communication, Jim Parrott, March 21, 1980). Thus, the present discharge of approximately 66 mgd into the Las Vegas Wash would not be changed significantly, and adverse impacts would be avoided. A letter (August 18, 1980) from David Houston, Assistant Director of the Clark County Comprehensive Planning Department indicates " . . . that the Reclaimed Water Purchase Agreement, which provides for delivery of water from the County AWT Plant to the Allen plant is being updated to reflect current construction timetables, quantity and quality considerations, and payment provisions. The agreement is expected to be finalized and endorsed before commencement of construction."

Wetlands and Floodplains

Executive Orders 11990 and 11988 require that Federal agencies give special consideration to the protection of wetlands and avoid locating structures or facilities that can be damaged by floodwaters within a 100-year floodplain.

The following project facilities are evaluated in terms of their probability for affecting wetlands and floodplains.

Coal Sources. The possible impacts to wetlands and floodplains from future coal development is not clearly understood because the actual areas to be mined and mining methods have not yet been identified by the mining operator(s) in a mine plan. UII is presently conducting a baseline hydrologic inventory of the Alton coal lease area. Information on flooding potential, and mapping and a physical description of all lease area drainage basins and appropriate drainage facilities will be developed. The information will be provided to OSM for their consideration in the current unsuitability evaluation of the Alton coal lease area.

Alton Coal Preparation Plant Site. No wetlands occur in this area. Present information indicates that the site is not located within a 100-year floodplain.

Coal Slurry Pipeline(s). The coal slurry pipeline would make seven subsurface crossings of major washes and streams. Construction and burial of the pipeline would disturb approximately 10 acres of wetlands or floodplains. Significant long-term disturbance would not be anticipated since the pipeline would be buried below the stream or wash scour line and disturbed surfaces would be revegetated.

Warner Valley Powerplant. No wetlands occur on this site. Present information indicates that the site is not located within a 100-year floodplain.

Warner Valley Water Project. The proposed water diversion of the Virgin River would have some effect on downstream wetlands as present river flows would be reduced by 56,100 acre-feet per year. The major area of effect would be between the point of diversion and the point where irrigation and other use return flows would re-enter the Virgin River (a distance of approximately 29 miles). Beyond this point, wetlands would be affected by the anticipated consumptive water use of 21,000 acre-feet per year. The significance of these effects has not yet been determined; however, USFWS will make detailed recommendations as stipulations to issuance of a 404 Permit if the Warner Valley water project is approved.

Approximately 750 acres of land within the 100-year floodplains of several washes in the northern portion of Warner Valley, Utah would be utilized in the proposed water project development. Most of the affected lands (720 acres) would be inundated by the water proposed for impoundment. The proposed reservoir would have the effect of turning these existing floodplains into a permanent body of water.

Harry Allen Powerplant. The proposed powerplant would be located within the normal floodplain of Dry Lake playa. Proposed dikes would protect the plant from flooding during a 50-year flood event. As noted previously, approximately 1,850 acres would be removed from the existing playa, which would have the effect of raising flood levels by about 8.5 feet above natural levels in the remaining portions of the playa. The potential for flooding of the powerplant site by a 100-year flood event and its impacts will be determined by the U.S. Army Corps of Engineers before the final design of the powerplant would be completed.

Electrical Transmission System. Eight identified flood hazard zones would be crossed by transmission lines. Although the actual amount of land that would be involved is unknown, it would probably be quite small, since the lines would span the river channels whenever possible.

Vegetation: Species of Concern

Several species of concern in the States affected (listed in Appendix 7) could be adversely impacted by the various components of this alternative. Although not expected to be great, the significance of such impacts is unknown due to the lack of actual on-ground information. According to standard

operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Their recommendations for mitigating impacts to vegetation are found in the Technical Assistance Report in Appendix 15.

Alton Coal Lease Area

NPS has expressed concern that revegetation of coal-mined lands south of Bryce Canyon National Park could introduce plants not native to the area. Should this occur, it would be possible that these introduced plant species could eventually become established within the park, thereby further altering its natural character.

Warner Valley Powerplant and Water Project

On December 28, 1979, official consultation with USFWS was initiated concerning endangered plants according to Section 7 of the Endangered Species Act (as amended 1978). At that time USFWS indicated that three endangered plants (Echinocereus englemannii var. purpureus, Pediocactus sileri, and Arctomecon humilis) could possibly occur within the project area. A biological assessment on these plants was completed by BLM (1980) and transmitted to USFWS. The biological assessment indicates a "no effect" determination for Echinocereus englemannii var. purpureus and an "adverse effect" determination for Pediocactus sileri and Arctomecon humilis.

According to a subsequent USFWS biological opinion (Appendix 16), a population of 80 to 100 endangered siler pincushion cacti (Pediocactus sileri) would be lost due to construction of solid waste disposal areas over their habitat. Although endangered, the loss of 80 to 100 of these cacti represents less than 1 percent of their total number and the impact would not be significant.

Because of the location of dwarf bearclaw poppy (Arctomecon humilis) habitat near existing roads between St. George and the proposed Warner Valley powerplant and water project sites (fig. 3-6), one of the two existing populations of this plant would be adversely impacted from accelerated population growth and road use associated with the construction and operation of the powerplant and water project. Even with restricted access, numbers of the plant would be run over by off-road vehicle (ORV) recreationists or lost to collectors. According to the USFWS biological opinion, the area to be affected by the construction and operation of the powerplant and water project represents the only known habitat of the dwarf bearclaw poppy. Additional impacts to the area inhabited by the dwarf bearclaw poppy could result from water seepage from the Warner Valley reservoir, which would change the dry site to a more mesic one. The likelihood of this occurring cannot be determined without additional geologic information. Worst case analysis indicates that the water project would threaten the continued existence of the bearclaw poppy.

Coal Slurry Pipeline

The dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri) would also be adversely affected by the

construction of the coal slurry pipeline near the city of St. George. The BLM biological assessment indicates that while individual plants may be destroyed, neither species as a whole would be significantly affected. The USFWS biological opinion (March 1980) also supports this assessment.

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted by the various components of this alternative in the affected States (Appendix 8). Although not expected to be great, the significance of such impacts is unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Their recommendations for mitigating impacts to wildlife can be found in the Technical Assistance Report (Appendix 15).

Coal Slurry Pipeline and Electrical Transmission System

The desert tortoise (Gopherus agassizii) has recently been listed as threatened in Utah (Federal Register, Volume 45, Number 163) and is protected in the States of Arizona, Nevada, and California. According to the USFWS biological opinion (July 1980), impacts to tortoise populations in Utah would not be significant because the routes proposed for the construction of the slurry pipelines and transmission lines would lie essentially south of an area listed as critical habitat by USFWS. However, desert tortoise could be adversely impacted during construction of the slurry or transmission lines due to vehicle/animal collisions and human capture during construction on as many as 12,684 acres of potential habitat (fig. 3-6). The result could be reductions in local populations of the tortoise.

Warner Valley Water Project

The Warner Valley water project as previously proposed by the applicants (1975), would have diverted up to 160 ft³/s while allowing at least a minimum flow of 40 ft³/s to bypass the diversion in order to meet downstream water rights. In response to this proposed project and after consultation with BLM in accordance with Section 7 of the Endangered Species Act (as amended 1978), USFWS issued an official biological opinion (1978) stating that: "It is our opinion that the Warner Valley [water] project as now proposed will be likely to jeopardize the continued existence of the endangered woundfin minnow [Plagopterus argentissimus] by adversely modifying its present habitat in the Virgin River. This habitat is considered essential for survival of the species and has been proposed for designation as 'critical habitat', as provided for by the Endangered Species Act of 1973, in the Federal Register, Volume 42, Number 211" (Appendix 15). USFWS also recommended in their opinion a minimum flow criterion of 70 ft³/s for the months of July through October and 110 ft³/s for all other months as recorded at the Hurricane gaging station in order to protect the habitat of the woundfin minnow.

In response to the biological opinion, the Washington County Water Conservancy District submitted a redesigned diversion schedule for the water project. The Warner Valley water project as redesigned by the applicant would divert water from the Virgin River at a rate of up to 160 ft³/s, but

would allow at least a minimum flow of 40 ft³/s to bypass the diversion during the months of October to February, 90 ft³/s from March to June, and 80 ft³/s from July to September (letter to the BLM Cedar City District Office from Washington County Water Conservancy District, October 31, 1979).

It was the position of USFWS (1978) that any diversion of the Virgin River that would not permit the flow criterion (as mentioned above) would not be considered compatible with the protection of this endangered fish until a revised biological opinion is issued.

BLM reinitiated consultation with USFWS in order to consider the re-designed water project. Following this, a joint study among representatives of BLM, USFWS, and Utah Division of Wildlife Resources (UDWR) was undertaken during the summer of 1980. The primary purpose of the study was to obtain new data regarding woundfin habitat requirements, habitat availability, and historical flows of the Virgin River. The USFWS biological opinion (completed at the conclusion of the study) indicates the Warner Valley water project (as modified) would be as restrictive in terms of recommended flow requirements for the woundfin minnow as those recommended in the 1978 biological opinion. The results of this study have been incorporated into the USFWS official revised official biological opinion (Appendix 15).

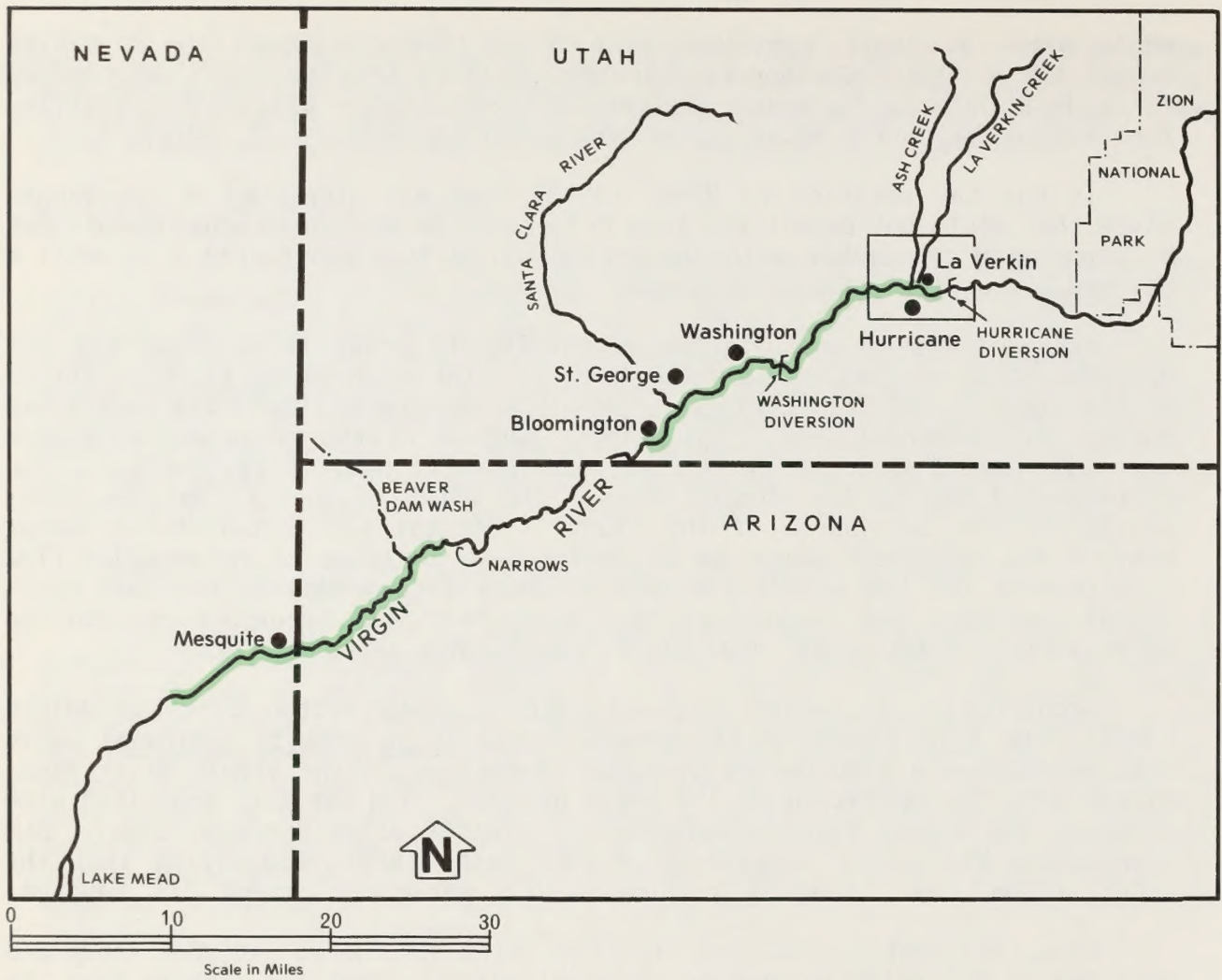
According to a report prepared by Drs. James Deacon and Paul Holden (1977), the rare Virgin River roundtail chub (Gila robusta seminuda) would also be adversely affected by proposed diversions of the Virgin River associated with the operation of the water project. BLM has also consulted with USFWS on the Virgin River roundtail chub (letter dated March 5, 1980). BLM prepared a biological assessment on the fish (1980) recognizing that the water project as currently proposed would adversely impact its habitat.

Also, information obtained from the joint BLM, USFWS and UDWR study and included in the USFWS biological opinion indicates that the impacts from the Warner Valley water project on the Virgin River roundtail chub would be similar to those expressed for the woundfin minnow.

The primary adverse impacts to the woundfin minnow and Virgin River roundtail chub would be attributed to reduced flows in the Virgin River. Reduced flows downstream from the proposed water project diversion would adversely affect these fishes by reducing their populations and habitat downriver to the Virgin River narrows (fig. 4-9). Secondary impacts to the fishes associated with stream flow alterations would be changes in water quality (increased salinity), temperature (changes in critical biological temperatures), the possible introduction of exotic fish species into the reservoir, and outfalls, which could lead to competition and possible reduction of the Virgin River roundtail chub and the extinction of the woundfin minnow (USDI, USFWS, 1978; Biological Assessment, USDI, BLM, 1980).

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. It is assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register of Historic



LEGEND

Areas where Woundfin and Virgin River Roundtail Chub populations would be adversely impacted due to reduced river flows.

FIGURE 4-9

WOUNDFIN AND ROUNDTAIL CHUB HABITAT AFFECTED BY
PROPOSED DIVERSIONS OF THE VIRGIN RIVER

Places caliber under the criteria that they "... have yielded, or may be likely to yield, information important in prehistory" (36 CFR, Part 60).

Should an alternative be approved, full and complete inventories would be accomplished according to Standard Operating Procedures (Appendix 6) in accordance with the action plan for compliance with the Advisory Council of Historic Preservation procedures for the protection of historic and cultural resources (Appendix 9), and by the provisions of the "Memorandums of Understanding" developed with the State Historic Preservation Officers (SHPO) involved in the project (Appendix 9).

Alton Coal Lease Area

Based on the average site density of one site per 43 acres, an estimated 236 sites would be adversely impacted during mining activities on 10,154 acres. At least 177 sites would probably be of National Register caliber. Increased population pressure could lead to increased vandalism of some local sites. No significant historical properties are presently known in the Alton coal lease area.

Coal Slurry Pipeline

According to Fowler (1975), 53 archaeological sites were encountered within or adjacent to the pipeline study corridor. An estimated 15 of these sites would be adversely impacted by construction activities. At least 12 of these sites would probably be of National Register caliber. An inestimable number of unknown (buried) sites could also be impacted. A 1,000-acre easement for maintenance access would be maintained throughout the life of the project. The balance of archaeological sites would be subject to secondary adverse impacts of vandalism because of increased access to the sites.

Construction of the slurryline would temporarily impact visitation to the Fort Pierce National Register Property, which lies just 0.25 mile south of the proposed route in Warner Valley (fig 2-4). It is assumed that no further impact would occur after construction because the site was recently stabilized and upgraded to accommodate substantially more use than it is presently experiencing.

Construction and operation of the slurry pipeline would indirectly impact the Honeymoon Trail, which is nominated to the National Register (fig. 2-4). The slurry pipeline would be constructed some 1,500 to 4,000 feet north of the Honeymoon Trail where it descends the Hurricane Cliffs. Construction would alter the existing landscape character, leaving permanent scars due to cut and fill operations adjacent to portions of the trail which lie east of the cliffs. The trail itself would not be harmed. Construction of a microwave station, air strip, and valve station at the top of the Hurricane Cliffs would alter the existing landscape and visual character of the area through which the trail passes.

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Warner Valley Powerplant

Construction of the powerplant would destroy eight known archaeological sites (Thompson and Thompson, 1976). These sites have not been submitted for determination of eligibility, but five or six would probably meet National Register criteria.

The Warner Valley portions of the Dominguez-Escalante, Honeymoon, and Temple Trails would be impacted by the construction and operation of the Warner Valley powerplant. The proposed right-of-way for the Warner Valley powerplant would place the facility over a portion of the Dominguez-Escalante Trail (fig. 2-4). The powerplant would conflict with a NPS proposal to add the Warner Valley portion of this trail to the National Historic and Scenic Trails System. Although the proposed powerplant right-of-way would not directly affect the Honeymoon and Temple Trails, their Warner Valley segments would be indirectly impacted by construction and operation of the plant.

Warner Valley Water Project

The proposed diversion structure to be built on the Virgin River would, as designed, cause the destruction of the Hurricane Canal/Diversion, a system built by early Mormon settlers to divert waters of the river to their Hurricane fields for irrigation purposes. The Hurricane Diversion structure and 6.5 miles of the canal have recently been listed on the National Register of Historic Places. Construction of the proposed diversion and canal structure needed to feed water to the proposed reservoir would destroy the historic diversion structure as well as occupy portions of its canal for channeling waters to the reservoir (Washington County Water Conservancy District, 1975).

Electrical Transmission System

Construction of the transmission system could adversely impact archaeological sites on 11,434 acres of right-of-way. Segments of the transmission system are considered separately because of their geographical distribution.

Spry to Alton. The nature and extent of the cultural resources along the Spry to Alton corridor are poorly known and it is difficult to qualify or quantify significant impacts. However, an estimated 17 sites would be impacted, including at least 13 that may be of National Register caliber.

Warner to St. George. The proposed corridor from the Warner powerplant to St. George has not yet been surveyed. Exact surveying and alignment would determine whether or not any cultural resources would be involved. An estimated three sites would be impacted, two of which would probably be of National Register caliber.

Warner to Pecos. Portions of this corridor have been surveyed for cultural resource values but no significant archaeological sites were located (Turner et al., 1975). Certain segments paralleling the Navajo-McCullough transmission line have yet to be surveyed. An estimated 24 sites would be impacted, including an estimated 18 sites probably of National Register caliber.

Allen to Eldorado. The segment from the Harry Allen powerplant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would probably be of National Register caliber.

Western Transmission System. The number of archaeological sites that would be adversely impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979).

Interstate 15. An estimated 35 sites would be impacted along this alternative route, an estimated 26 of which may be of National Register caliber.

Eldorado-Lugo. An estimated 31 sites would be impacted, 23 of which may be of National Register caliber.

Victorville-McCullough. An estimated 58 sites would be impacted, 44 of which are possibly of National Register caliber.

Highway 66. An estimated 29 sites would be impacted, 22 of which are possibly of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with American Indian Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Alton Coal Lease Area

Normal mining operations in the Alton East coal lease area would be visible from observations points on the southern rim of the Paunsaugunt Plateau, and especially for more than 300,000 annual visitors to Yovimpa Point in Bryce Canyon National Park. Approximately 10 miles of the extreme eastern portion of the Alton East coal lease area would be visible from Yovimpa Point, with active mining visible from as close as 4 miles from this location. No surface mining would be seen from Yovimpa Point until mining progressed to Table Mountain. This would occur about 7 years after the commencement of mining. Active surface mining would be visible from Yovimpa Point for approximately 21 years. Of the approximately 5,250 surface minable acres in Alton East, about 1,500 would be visible from Yovimpa Point (fig. 3-10).

The area of the greatest amount of disturbance (mining on about 260 acres) distinguishable from the park would occur at a distance approximately 8 miles from Yovimpa Point, however, active mining activities would be most noticeable at a distance of 4 miles from Yovimpa Point. Modifications to line, form, color, and textural elements of the pre-existing landscape would

occur during mining and the early stages of reclamation. Initially, pinyon-juniper woodlands and stands of big sagebrush would be removed from the area prior to strip mining. While active mining continued and during the early stages of reclamation, the lease area would be a major intrusion on the landscape as viewed from Yovimpa Point. Visual Resource Management Classes II, III, and IV in the lease area would be exceeded during the mining operations. However, in less than 10 years after successful reclamation, the Class III and IV areas' management criteria would be satisfied. It has not been determined if VRM Class II objectives would be satisfied after reclamation.

Planned construction at Bryce Canyon National Park in fiscal year 1980 indicates the upgrading of the nature trail and the development of a viewpoint on the Promontory, which is higher in elevation and further east than Yovimpa Point. Mining of Alton East coal lease area would be a greater visual intrusion from this point.

Strip mining the Alton East lease area as identified in Chapter 2 would conflict with a NPS recommendation to OSM that portions of the Alton East lease area which are adjacent to or visible from Bryce Canyon be declared unsuitable for mining (Recreation and Aesthetics section of Chapter 3; fig. 3-10). This alternative would also conflict with BLM's Management Framework Plan for Coal Management in Zion Planning Unit. Approximately 600 acres of the Alton East lease area would be unacceptable for surface mining under BLM's unsuitability criteria (Recreation and Aesthetics section, Chapter 3; fig. 3-10).

In addition to the visible effects of mining on the landscape, blasting and noise associated with normal mining operations would impact recreational and aesthetic values (SUPED, USDI, OSM, 1980). Blasting (required to remove overburden and coal) would generate dust plumes that would be readily visible from Yovimpa Point. During the peak summer visitor months (June through August) seasonal winds would carry blasting and heavy equipment generated dust toward the park. The SAI (1980) estimates that the visibility could be impaired by 5 to 25 percent from mine generated dust when viewing from Yovimpa Point toward the mining areas. Visibility reductions could also impair a viewer's ability to view the Grand Staircase.

Studies conducted in conjunction with SUPED (USDI, OSM, 1980) have indicated that vibrations associated with blasting would not have an adverse impact on the erosional forms of Bryce Canyon National Park or Dixie National Forest.

Surface mining noise generated in the Alton East lease area would be distinctly audible in Bryce Canyon National Park, with the most serious impacts occurring at Yovimpa Point. Noise from mining the Alton West area would also be audible in the park. Surface mining noise would generally come from two sources: coal trucks and blasting. Coal trucks in the Alton East area would produce maximum noise levels from 28 to 59 decibels at Yovimpa Point. This would cause an increase by two to sixteen times in the currently perceived noise levels. Truck noise would be continuous and would be perceived as a droning at various levels (Foch and Oliver, 1980).

Blasting noise from the Alton East lease area would be as high as 86 decibels at Yovimpa Point, and could occur two to six times a day. Blasting noise could be perceived as being 64 times louder than current background noise levels (Foch and Oliver, 1980).

A visitor survey was conducted at Bryce Canyon National Park by NPS in the summer of 1980 in order to assess the effects that mining activities would have on the visitors' preception of park values. The park values which were considered most important to visitor enjoyment were the scenic views, intricate rock formations, natural forest, wildlife, solitude, and clean air. Seventy-six percent of the survey respondents that visited Yovimpa Point indicated their primary purpose for visiting this viewpoint was the vista. Based on NPS projections for the year 2004, from 799,315 to 1,446,810 people will visit Bryce Canyon National Park annually. According to the NPS, strip mining activities would decrease the value of visits for approximately 20 percent of the annual visitors for the 21 years of visible mining. Ten percent of the annual visitors would spend less time at Yovimpa Point, and 7 percent of the annual visitors would spend less time at the park for the 21 years of visible mining. The survey concluded that for the duration of visible mining (21 years) 2 percent of annual visitors would not want to visit Yovimpa Point and 1 percent of annual visitors would not want to visit the park should mining activities be visible from Yovimpa Point. One percent of the annual visitors would stay longer at Yovimpa Point and the park if mining activities were visible from Yovimpa Point (NPS, 1980).

Based on the NPS visitor survey, it appears that reductions in scenic and air quality resources due to proposed mining activities would decrease the value of the park visitors' experience and diminish the time visitors would spend in the park. Although a decrease in the exact number of visits to Bryce Canyon National Park cannot be quantified, a reduction in the amount of time tourists spend in the park would occur. This would result in a loss of revenue for local businesses (motels, restaurants, service stations, etc.) which cater to the tourists, thus impacting the local economy where tourism-related trade is the primary employer (Socioeconomics section in Chapter 3).

Coal Slurry Pipeline

The slurry pipeline would appear as a linear scar on the landscape, with the extent of landscape impacts dependent on the degree of vegetation modification. Major vegetation manipulations for below ground pipelines would have lasting effects on the landscape. The term of the impact would be dependent on climatic conditions of the site, type of vegetation affected, and construction techniques (Ross, 1979).

Areas in VRM Classes II (construction should not be evident), III (construction may be evident), and IV (construction may be very evident) would be crossed by the proposed slurry pipeline. Class II VRM objectives could not be met in the White Cliffs area near Upper Kanab Creek, at the Hurricane Cliffs, and on the Beaver Dam Mountains where construction on steep terrain would require notching and cutting, which would drastically alter the local natural topography and would result in a loss of scenic quality (fig. 3-9). The construction of roads required to permit pipeline development would permit increased access into previously inaccessible areas. This could cause an increase in ORV use with an associated destruction of vegetation, disturbance to wildlife habitat, and an increase in littering.

Warner Valley Powerplant

Visual resources in the St. George Basin would be adversely impacted by the presence of the powerplant and facilities. They would detract from the natural beauty of the surrounding landscape and would not meet VRM Class IV designations in the upper Warner Valley for the life of the project (fig. 4-10). The present aesthetic character of the basin would be further impacted by powerplant emissions. During stable air conditions (30 percent of the time), emissions would be chemically altered and could create a gray to yellowish-brown haze which would obstruct the viewer's perception of surrounding natural features and could decrease visual range in Zion National Park which lies approximately 20 miles northeast of the proposed powerplant site (Air Quality section of this alternative). Degradation of the visual resource would impact the recreational resources of hiking, sightseeing, etc.

No studies have been conducted to determine the impact of air quality degradation from the proposed Warner Valley powerplant on visitors to Zion National Park. Because the park's air quality resource is a major component of visitor enjoyment, any degradation of the resource could affect the value of park visitor experiences and the duration of time visitors spend in the park. This could result in a loss of revenue for local businesses (motels, restaurants, service stations, etc.) which cater to tourists, thus impacting the local economy where tourism-related trade is the primary employer (Socio-economics section in Chapter 3).

Warner Valley Water Project

The water project could have a positive impact on the visual and recreational resources of Warner Valley. The reservoir would create contrasting scenery in an otherwise arid setting in northern Warner Valley.

The 750-acre reservoir would create opportunities for water-oriented recreational activities such as boating, swimming, and fishing (fig. 4-11). Visitor use would increase at the reservoir site with recreationists primarily coming from the Cedar City and St. George, Utah and Las Vegas, Nevada areas. Recreational activities would be adversely affected when the reservoir storage capacity would fall below 20,000 acre-feet, corresponding to a 60-foot drawdown from the maximum storage level. A 60-foot drawdown would reduce reservoir surface area from 750 to 325 acres, exposing borrow areas and mud flats around the periphery of the reservoir (fig. 4-12). The mud flats would diminish the area's aesthetic appeal and dry dock boat launching facilities. Developed swimming areas would become unsuitable due to large expanses of mud between the beaches and the water. The 60-foot drawdown could reduce the reservoir's sport fishing potential by exposing spawning areas, which would result in reduced fish populations. Based on computer simulations, such a drawdown could occur 5 of every 35 years (Water Resources section, Chapter 4).

The diversion of water from the Virgin River to the Warner Valley reservoir could affect the river's recreational potential for river running. The diversion of up to 160 ft³/s of water during the spring runoff period could temporarily lower the river's flow rate below 500 ft³/s, which is the minimum flow necessary to support river running. Flows below 500 ft³/s could generally be expected to occur at the beginning and end of the spring runoff



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-10

VISUAL SIMULATION OF 500-MW WARNER VALLEY POWERPLANT



FIGURE 4-11

VISUAL SIMULATION OF THE PROPOSED
WARNER VALLEY RESERVOIR - FULL
(55,000 Acre-Feet)



FIGURE 4-12

VISUAL SIMULATION OF THE PROPOSED
WARNER VALLEY RESERVOIR - 60-FOOT DRAWDOWN
(20,000 Acre-Feet)

period. This would affect the recreational potential by reducing the number of days when the river is capable of supporting this type of recreational use. Additional information on the Warner Valley water project impacts on the Virgin River is available in the Water Resources and Wildlife sections of this alternative.

Harry Allen Powerplant

The construction of the powerplant would definitely detract from the natural visual character of the site for the life of the project. Presence of the plant and facilities would prevent the area from meeting VRM Class IV objectives. The powerplant emissions and plume would affect visual and recreational resources depending on weather conditions (Air Quality section). Visual quality would be reduced for sightseers, especially where Interstate Highway 15 passes within 1 mile of the proposed plant site (fig. 4-13).

Electrical Transmission System

Impacts to recreation would be expected along new transmission corridors due to the construction of corridor access roads on 11,434 acres of right-of-way. These roads would permit increased access to previously inaccessible areas, causing an increase in ORV use with an associated destruction of vegetation, disturbance to wildlife habitat, and littering. The Spry to Alton, Warner to St. George, and the Highway 66 transmission routes could be impacted by increased ORV access because their routes would not parallel existing corridors. Where new lines would parallel existing transmission corridors, impacts to recreational resources would be insignificant because access roads already exist.

Visual resources would be impacted with the presence of tower structures and transmission lines, which would detract from the surrounding scenery. The severity of detraction would depend on the placement of towers, orientation of lines, location of the observer, and the azimuth of the sun. These impacts would continue for the life of the project until lines would be dismantled. Specific visual impact areas for each of the transmission systems are indicated below. Figures 3-8 and 3-9 indicate the location of each segment and its VRM rating. Where more than one line would be routed down a corridor, a "crowding" effect would further detract from visual resource quality.

Spry to Alton. The proposed 84-mile Spry to Alton transmission line would pass through essentially rural and forest settings. Much of this land is of low visual quality and not unique. The line would generally be compatible with these environments except in the higher elevations of pinyon-juniper woodlands. The wooden transmission structures would not readily fade from view at greater distances and would cause the primary impact to visual resources (Garkane Power Association, 1979).

Warner to St. George. The proposed 138-kilovolt (kV) Warner to St. George transmission line would be highly visible from Warner Valley and Sand Mountain because the free-standing single wooden poles would not readily fade from view. The transmission route would pass through VRM Class IV areas in Warner Valley and Class II areas around the city of Washington, Utah, resulting in a loss of existing scenic quality.

Warner to Pecos. Impacts to existing visual resources would be minor because the Warner to Pecos line would parallel the existing Navajo-McCullough and Reid Gardner-Pecos corridors for most of its route. The Warner to Pecos transmission corridor would not physically impact the Joshua Tree National Natural Landmark because it would pass at a distance of approximately 1.5 miles. The route would, however, further detract from the surrounding landscape's visual quality with the addition of another transmission line.

Allen to Eldorado. The proposed Allen to Eldorado lines would parallel existing transmission lines for approximately 43 of its 48 miles. Visual impacts along the existing corridor would be minor. The greatest visual impacts would occur along the 5 miles of newly constructed transmission lines, especially where they would cross Interstate 15 (SCE and PG&E, 1979). The proposed Allen to Eldorado transmission route would follow an existing transmission corridor through the Frenchman Mountain/Rainbow Gardens/Las Vegas Wash area. The addition of a new transmission line in this existing corridor would not affect the development of the proposed Las Vegas Wash Wetlands Park (personal communication, Dirick Van Gorp, Clark County Parks and Recreation Department, September 11, 1980). This route would further detract from the surrounding landscape's visual quality because of the addition of another transmission line.

Western Transmission System. Transmission corridor alternatives are discussed separately below.

Interstate Highway 15. Much of the environment through which the corridor would pass is of moderate to low visual resource and is not unique. A 138-kV line presently occupies the proposed route. The Interstate 15 corridor would pass through McCullough Pass and adjacent to Afton Canyon. These areas have been identified by the Heritage Conservation and Recreation Service as being potential candidates for the National Natural Landmark program. In these areas the "crowding effect" would further detract from the scenery. Some major visible impacts could be expected in the vicinity of East Cronese Dry Lake, Cronese Valley, Dry Soda Lake, Halloran Springs, Ivanpah Valley, and the proposed East Mojave National Park. Impacts to the visual resource would also be noticeable when the lines would pass through the cities of Baker, Midway, Yermo, and Victorville, although cultural developments already detract from the surrounding landscape (SCE and PG&E, 1979).

Eldorado - Lugo. The Eldorado to Lugo transmission route would essentially parallel existing 220-kV and 500-kV powerlines. Where the proposed transmission route bisects the Kelso Dunes/Devil's Garden Area and runs adjacent to Pisgah Crater, the visual resource would be degraded due to the crowding effect. Visual impacts would occur in the following areas which are considered high in scenic value: Cinder Cone Natural Area, Cadiz Mountains, and the proposed East Mojave National Park. The view from the residential and subdivision areas of northwest Victorville would also be impacted. Several major transmission lines already degrade the scenic resource along this corridor. The addition of one or more lines would further detract from the surrounding landscape (SCE and PG&E, 1979).

Victorville - McCullough. Moderate visual impacts would occur on Daggett Ridge, Roach Lake, the McCullough Mountains, and the proposed East



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EXISTING SITUATION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-13

VISUAL SIMULATION OF 2,000-MW HARRY ALLEN POWERPLANT

Mojave National Park. High visual impacts would be expected at Red Pass Lake, Silver Lake, Shadow Valley, and the Clark Mountains. Visual impacts would be mainly associated with the visibility of towers and conductors. Several major lines already degrade local visual quality. The placement of additional transmission lines would further impact the visual resources (SCE and PG&E, 1979). Where the Victorville-McCullough route passes through the McCullough Pass the visual resources would be degraded due to the crowding effect.

Highway 66. The major portion of this alternative corridor is presently without transmission lines. The placement of the lines would cause a new intrusion on the landscape with subsequent visual resource degradation. Significant visual impacts would occur during construction, operation, and maintenance, especially in the following scenic areas: Pisgah Crater, Amboy Crater National Landmark, Piute Range, and the communities of Ludlow and Amboy (SCE and PG&E, 1979).

Wilderness

No BLM Wilderness Study Areas or Intensive Wilderness Inventory Units are within the areas designated for the proposed Warner Valley water project, Harry Allen powerplant, or the Alton coal lease area. Only the proposed coal slurry pipeline, the Warner Valley powerplant, and three of the western transmission system alternative routes could impact wilderness values.

Coal Slurry Pipeline

The routing of the pipeline as proposed would impact four Intensive Wilderness Inventory Units in Utah (fig. 3-9): Upper Kanab Creek (UT-040-255), East Mesa (UT-040-135), Cottonwood Canyon (UT-040-138), and Quail Draw (UT-040-134). These areas are currently managed under an "interim policy" by BLM so as not to impair their suitability for preservation as wilderness (FLPMA). Under interim management, the granting of rights-of-way for the proposed coal slurry pipeline would be prohibited. As indicated in Chapter 3 (Wilderness) these units have been recommended to be dropped from further wilderness consideration. Should these areas be determined to lack wilderness characteristics by the BLM State Director, they would be dropped from the wilderness review process and returned to multiple use management. In this event, the impacts created by the proposed slurry pipeline would be primarily associated with the construction of corridor access roads. These roads would permit increased access to previously inaccessible areas, causing an increase in ORV use and an associated destruction of vegetation, disturbance to wildlife habitat, and littering.

After construction, the slurry pipeline would appear as a linear scar on the landscape, with the extent of landscape impacts dependent on the degree of vegetation modification. Major vegetation manipulations for below-ground pipelines would have lasting effects on the landscape. The term of the impact would be dependent on climatic conditions, type of vegetation affected, and construction techniques (Ross, 1979).

Warner Valley Powerplant

The proposed powerplant site would conflict with a portion of the BLM Cottonwood Canyon Intensive Wilderness Inventory Unit (UT-040-138; fig. 3-9). As described in the preceding component, this inventory unit is currently under interim management that prohibits the granting of rights-of-way. As indicated in the Wilderness section of Chapter 3, the Cottonwood Canyon Unit has been recommended to be dropped from further wilderness consideration, with a final decision to be announced on November 15, 1980.

Electrical Transmission System

Western Transmission System. Three alternative corridors would, as proposed, conflict with BLM Wilderness Study Areas in southern California. As discussed in Chapter 3 (Wilderness), these areas are managed under an interim policy so as not to impair their suitability for preservation as wilderness. The granting of rights-of-way in these areas is prohibited (FLPMA). Interim management of these areas will continue until a decision is made to recommend (or not recommend) them to Congress for designation as Wilderness Areas. A proposed microwave communication site atop Clipper Mountain, west of Essex, California would also conflict with a Wilderness Study Area.

Interstate 15. This alternative route would not cross any Wilderness Study Areas.

Eldorado - Lugo. This alternative route would cross ten Wilderness Study Areas (fig. 3-8).

Highway 66. This alternative route would cross one Wilderness Study Area (fig. 3-8).

Victorville - McCullough. This alternative route would cross seven Wilderness Study Areas (fig. 3-8).

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-2. Present land use would be changed on affected acreage during the 40-year life of the project as indicated below. After decommissioning, these areas would be available for other uses or would revert to pre-existing land uses.

<u>Component</u>	<u>Acres Affected</u>	<u>Present Land Use</u>	<u>Project Use</u>
Alton Coal Lease Area	8,328	Range, Wildlife	Surface and under-ground mining of 300 to 400 acres per year
Coal Preparation Plant	1,826	Range, Cropland	Heavy industrial

<u>Component</u>	<u>Acres Affected</u>	<u>Present Land Use</u>	<u>Project Use</u>
Warner Valley Power-plant	4,295	Range, Recreation	Heavy industrial
Warner Valley Water Project	2,993	Range, Recreation	Reservoir, recreation
Harry Allen Powerplant	5,887	Recreation, Wild- life	Heavy industrial
Coal Slurry Pipeline	2,218	Range, Recreation, Wildlife	No change on unfenced right-of-way (tempo- rary impact during con- struction); 1,000 acres of maintained easement
Electrical Transmis- sion System	11,434	Range, Recreation, Wildlife	No change on unfenced right-of-way (tempo- rary impact during con- struction); 423 acres of maintained access roads

Alton Coal Lease Area

The principal impacts to land use, and land use plans and controls are described in SUPED (USDI, OSM, 1980). Lands under coal leases proposed for development are currently zoned by the Kane County Planning Commission as "agricultural", under which mining is not permitted and "forest/recreation", under which underground mining is permitted but surface mining is conditionally permitted only after the approval by the planning commission (personal communication, Robert Russell, Kane County Commissioner, November 19, 1979). The planning commission is attempting at present to change the zoning for the entire lease area to permit conditional surface mining. This change in land use zoning would require public approval (personal communication, Robert Houston, Kane County Commissioner, February 4, 1980). Should the zoning ordinance not be changed, mining would not be permitted in certain areas.

Surface mining on approximately 1,600 acres within the Alton coal lease area would be in conflict with the BLM Management Framework Plan for Coal Management in Zion Planning Unit (fig. 3-10). This acreage, included in the area of the Alton-Kanab Known Recoverable Coal Resources Area, has been declared unsuitable for mining under BLM unsuitability criteria (Management Framework Plan for Coal, USDI, BLM, 1980).

Coal Slurry Pipeline

An in-depth description of land ownership and proposed pipeline crossing of lands is available in Allen-Warner Valley Energy System: Environmental Assessment, Volume 2 (NPC, 1975).

If either a House bill (HR 5584 October 1, 1979) or a similar Senate bill (S. 1135) introduced in Congress to provide trust lands for the Moapa Band-Paiute Indians in Nevada are passed, conflicts with the proposed slurry pipeline rights-of-way could occur as the granting of rights-of-way would be subject to tribal authority. The House bill has provisions that would grant the land subject to a proposed corridor 1,500 feet to either side of the existing Navajo-McCullough transmission line, but the Senate bill does not.

Warner Valley Powerplant

The construction and operation of the powerplant would necessitate a change in zoning from open space to the heavy industrial category. The zoning change would have to be approved by the Washington County Planning Commission.

There would be no other significant conflicts with State, county, or BLM administered (public) land use plans or controls.

Warner Valley Water Project

Zoning changes by the Washington County Commission would be required for the acreage affected by the construction and operation of the project. Land use on 2,035 acres of public land, 688 acres of State land, and 270 acres of private land would have to be changed from the present multiple-use management category to a municipal-industrial based primary use reservoir, and secondary agricultural use and land use on the land adjacent to the proposed reservoir would have to be changed from multiple use to recreational use.

According to the applicant, 8,000 acre-feet of water would be allocated to annual agricultural use (for a supplemental water supply for 8,930 presently irrigated acres). With 10,000 acre-feet per year to go to electrical energy production at the Warner Valley powerplant, the balance of 31,000 acre-feet would be available to surrounding communities for municipal and industrial uses (memorandum from Rudger McArthur, Secretary-Treasurer, Washington County Water Conservancy District, December 6, 1979). This would have the effect of encouraging future residential and industrial growth in the communities affected, which could require the re-evaluation of current land use plans and controls in Washington County.

Harry Allen Powerplant

Approximately 5,886 acres of public land would change from the present multiple-use status to single use/heavy industrial under the BLM Virgin Valley Planning Unit in the Caliente Resource Area of Nevada (Management Framework Plan, USDI, BLM, 1974). A zoning change for 5,886 acres from the present rural open category to the heavy industrial category would have to be approved by the Clark County Comprehensive Planning and Environmental Commission with public participation.

The applicants would have to secure a right-of-way to route the Clark County AWT pipeline across a portion of Nellis Air Force Base in southern Nevada. A right-of-way could be issued by the Air Force if the action would not interfere with the mission of the base, and if the action would be for the good of the public (personal communication, Barbara Hein, Real Estate Specialist, Nellis Air Force Base, April 30, 1980).

Electrical Transmission System

Approximately 11,434 acres of rights-of-way and easements would be required for the construction of the transmission system. No conflicts with local, State, or Federal government land use plans or controls would be expected with the construction and operation of the Spry to Alton, Warner to St. George, or Allen to Eldorado transmission lines.

Because of actual land use and land use planning, only a few specified corridors would be used for the routing of transmission lines. Problems of transmission line crowding would occur near the Rainbow Gardens area, in Eldorado Valley, through the McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or the Victorville-McCullough alternative corridors of the Western Transmission System in southern California. The crowding of these corridors would preclude or otherwise impact other existing or potential land uses for the same area. Problems could also arise in the limitation or preclusion of future transmission line routings.

Warner to Pecos. The proposed Warner to Pecos transmission corridor could be in conflict with one of two bills which have been introduced in Congress that would provide trust lands for the Moapa Band-Paiute Indians near Moapa, Nevada. The House bill (HR 5584) would grant lands subject to existing rights-of-way but the Senate bill would not. Should one of the bills pass in Congress, the granting of rights-of-way would be subject to tribal authority.

The applicants would have to secure a right-of-way to route the line across a portion of Nellis Air Force Base in southern Nevada. The base would grant a right-of-way as long as the action would not interfere with the mission of the base and if the action would be for the good of the public.

Allen to Eldorado. Should the city council of Henderson, Nevada decide to deny use permits for the routing of the electrical transmission system through the incorporated city limits, the applicants would have to find other corridors for the routing of transmission lines.

Western Transmission System. The route of this proposed transmission system would run through southern California. The four alternative transmission routes of this system would utilize utility corridors identified in the California Desert Conservation Area Final Environmental Statement and Proposed Plan (USDI, BLM, 1980). The I-15 and Victorville-McCullough transmission routes would occur within planning corridors that have been identified for expansion. Portions of the Highway 66 and Eldorado-Lugo alternative routes would, however, follow "contingent" corridors, and would require an amendment to the Plan before rights-of-way could be approved.

Socioeconomics

The direct manpower requirements supplied by the project proponents plus anticipated secondary and induced population growth have been added to baseline population figures to project socioeconomic impacts generated by project components under this alternative (discussed in the Socioeconomics section of Chapter 3). The impact of the project is then defined as the difference between what the population is projected to be under baseline conditions

(without the project) as compared to what it would be with the project. Such impacts are then translated into changes in employment and income, and increases in demands for various services. Tables containing detailed projections of impacts to population, employment and income, and services are contained in Appendix 17. Summaries of these projections are contained in the narration below.

Major socioeconomic impacts generated by the project components under this alternative would be caused primarily by population surges during construction phases. After construction of various facilities, rapid population changes would be expected to level out and growth rates would be expected to return to more normal levels. With the exception of the Alton mine complex, the operational work forces would be considerably smaller than those required during construction, so most impacts would be of a temporary nature. Most construction phase impacts would be short-term, lasting from a maximum 2 to 5 years. Those impacts which would occur would primarily affect the infrastructural services of the affected communities and counties.

Impacts to Kane County and Its Communities

Project components which would affect Kane County and its communities would be: the construction and operation of the Alton mine complex; and two coal slurrylines.

Population. Kane County communities would be expected to receive significant increases in their base populations. The most dramatic changes in population would occur between 1980 and 1985, primarily from temporary construction workers on the slurry pipeline (lasting less than 5 years), and an influx of miners at the Alton mine. These impacts are projected in table 1-1 of Appendix 17 through the year 2000. The information below shows the anticipated population changes for the initial 5-year period:

<u>Community</u>	<u>1980 Baseline</u>	<u>1985 Baseline Pro- jection</u>	<u>Popu- lation with Project (1985)</u>	<u>Increment Due to Project</u>	<u>Percent Annual Compound Growth</u>	
					<u>Without Project</u>	<u>With Project</u>
Kane County	3,929	5,040	7,706	2,666	5.11	14.42
Alton	75	50	206	156	-5.92	22.39
Glendale	235	312	810	498	5.83	28.08
Kanab	2,095	2,908	4,299	1,391	6.78	15.46
Orderville	428	512	1,133	621	3.65	21.49

Source: BLM, Calculated from Centaur Associates Inc., Socioeconomics, 1980

According to local planning documents (Five County Association of Governments, 1976), around 14 to 15-percent growth rates are the maximum that communities could absorb without major deterioration in services that municipalities must provide. It is obvious that most of the smaller Kane County communities would experience extreme problems in controlling growth and in providing services for projected increases in their populations.

Employment and Income. Implementation of this alternative would effect major changes in countywide employment characteristics. Aside from

the obvious upsurge in the mining and construction sectors, other support-oriented sectors would also be affected significantly. Primary among these, especially after the initial construction period, would be TCU (transportation, communications, and utilities), trade, FIRE (finance, insurance, and real estate), services, and government. Mining would move from a position of virtually no employment in the county to being its leading employer. Between 1980 and 1985 mining employment would go from 0 to around 510. In the period 1985 to 1990 such employment would increase an additional 65 percent to 840. With positive impacts to employment, there would be reciprocal impacts to incomes and earnings as shown in the following table:

	Temporary Con- struction	Operating Personnel		Indirect Impacts	Total
		Harry Allen Powerplant	Slurry Pipeline		
1985					
Employment	136	520	52	354	1,062
Income	3,294.9	^a 13,147.1	a	3,831.7	20,228.7
1990					
Employment	0	840	52	446	1,338
Income	0	^a 23,446.9	a	5,078.0	28,524.9
1995					
Employment	0	1,015	52	554	1,621
Income	0	^a 30,520.8	a	6,961.8	37,482.6
2000					
Employment	0	1,080	52	566	1,698
Income	0	^a 35,810.1	a	6,962.5	42,772.6

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aIncomes for Operating Personnel are not broken out by category.

Services. The provision of basic services in Kane County communities would be affected by this alternative, especially during the period 1980-1985. Kanab would probably be the most affected because it is the county's largest population center. Police and fire protection would have to be increased almost immediately. By 1985 the entire county would be experiencing shortages in such areas as water supply, sewage disposal, the school system (which in many cases is already experiencing chronic over-crowding), and health care services. After the initial 1980-1985 growth period, populations should stabilize to more normal growth patterns and any additional infrastructural needs should be more readily accommodated. The following table summarizes the points in time that the capacities of existing services or those currently under construction would be exceeded by combined baseline and project related population increases. The information is a composite of more detailed data contained in Appendixes 11 and 17.

<u>Community</u>	<u>Law Enforce- ment Needs</u>	<u>Fire Protec- tion Needs</u>	<u>Water Supply Needs</u>	<u>Sewage Treatment Capacity Needs</u>	<u>School Staff Needs</u>	<u>Health Care Facility Needs</u>
Kane County	...	...	...	...	1980- 1985	...
Alton	a	a	b	b	...	a
Glendale	a	a	1980- 1985	1980- 1985	...	a
Kanab	a	1985- 1990	1980- 1985	a	...	a
Orderville	a	a	1980- 1985	1980- 1985	...	a

Source: BLM, See Appendixes 11 and 17

^aExisting facilities or staffing already at or near capacity.

^bExisting capacities not projected to be exceeded before the year 2000.

Project proponents estimate that components in Kane County (coal fields and pipeline facilities) would have a market value of nearly \$190 million (Five County Association of Governments, 1976). Based upon a Kane County taxing formula of assessed value equalling 9.8 percent of market value (Utah Industrial Development Division, 1978), assessed values in the county would be raised from \$11.31 million (Utah Foundation, 1979) by approximately \$18.62 million (to \$29.94 million) or about a 164-percent increase. Based upon a mill levy of 59 mills, this increase in assessed valuation would yield an increase in property tax revenues to the county and school district of around \$1.1 million annually. While this appears to be a very substantial increase in financial resources for the county, it should be remembered that a very substantial increase in demands for services will attend or precede the receipt of such revenues.

In addition to increased property tax revenues, some \$842,000 in coal royalties would be returned to the county each year. Of this amount, \$790,000 would be dedicated to the reclamation fund. The remaining \$52,000 per year would go to county highways.

Quality of Life. Since this alternative would generate rapid increases in population in some portions of the county, it would be expected that some major infrastructural problems would result, especially during the early stages of the project. It could also be anticipated that if the sociological makeup of the "newcomers" would be substantially different from the existing relatively homogeneous base population, friction between the two groups could result. Also, as a result of the projected lodge influx of high paying construction and mining jobs, instances of localized inflation could occur as demands outstrip supplies. Such conditions would be especially acute for low and fixed-income residents. As such, it is possible that much of the burden created by the project could be borne by segments of the

population not in a position to participate in the benefits that would result from the project. Therefore, a decline in general quality of life would be expected, especially during the initial stages of the project. As infrastructural problems would be resolved and various subgroups became acclimated to one another, the quality of life problems should be somewhat relieved.

Conclusion. While providing increased employment and income opportunities in the county, this alternative would probably generate some very major infrastructural and sociological problems. Increased incomes and expanded tax bases would be very beneficial for the county, but would have to offset added loads in such areas as law enforcement, sewage treatment, education, health care, etc. Also, there are a number of Federally funded programs designed to at least partially offset the impacts to energy impacted communities. A collection of descriptions of these programs has been compiled by the Mountain Plains Federal Regional Council entitled Federal Assistance for Energy Impacted Communities and is available through the Federal Regional Council Energy Impact Office, Federal Building, 1961 Stout Street, Denver, Colorado 80294. An equity between such benefits and burdens would, however, probably not be achieved rapidly enough to displace anticipated initial impacts. To help offset such timing differences between the "costs" and "benefits" of the project, there are a variety of State laws which provide for such actions as prefinancing of public services, revenue sharing, resolving taxing imbalances, prepayment of taxes, and other sources of public improvement financing. Descriptions of these laws are contained in a memo from the State of Utah Department of Community and Economic Development (Appendix 18).

Impacts to Washington County and Its Communities

Project components which would directly affect Washington County and its communities would be: the Warner Valley coal-fired powerplant; the Warner Valley and Harry Allen coal slurry pipelines; and the Warner Valley water project.

Population. Population impacts from this alternative in Washington County would be significant. Several communities (Ivins, Santa Clara, and Washington) are already experiencing growth rates in excess of 11 percent, and additional increases in growth could create problems (table 1 of Appendix 11). Other communities (Hurricane, Leeds, St. George, and Toquerville) have more moderate growth rates, usually less than 5 percent, and could in most cases accommodate some population increases more readily. Anticipated population impacts for Washington County under this alternative are projected in table 1-1 of Appendix 17 through the year 2000. The information below shows the anticipated population changes for the initial 5-year period during which the most significant impacts would be expected to occur:

Community	1980 Baseline	1985 Baseline Pro- jection	Popu- lation with Project (1985)	Increment Due to Project	Percent Annual Compound Growth	
					Without Project	With Project
Washington County	24,901	30,578	38,681	8,103	4.19	9.21
Hurricane	2,379	2,565	3,198	633	1.52	6.10
Ivins	594	599	774	175	0.17	5.44
LaVerkin	1,167	1,272	1,571	299	1.74	6.13
Leeds	217	269	332	63	4.39	8.88
St. George	11,111	15,167	20,632	5,465	6.42	13.18
Santa Clara	1,063	1,040	1,393	353	-0.43	5.56
Toquerville	282	266	337	71	-1.11	3.63
Washington	2,218	2,413	3,461	1,048	1.70	9.31

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

It should be noted that the above impacts do not include projections for induced growth in the area that would result from the abundance of power and water produced under this alternative. Such an abundance could serve to stimulate more growth through the potential attraction of light industry to the area.

Employment and Income. Overall employment within the county would be expected to increase significantly with the implementation of this alternative. Direct project oriented employment in the county would create over 1,000 jobs during the construction phase. During the operational phase of the project, direct plus indirect employment would range from around 575 to 675 jobs over the long term. The figures below display the distribution of estimated employment and income impacts through the year 2000:

	Temporary Con- struction	Operating Personnel			Indirect Impacts	Total
		Warner Valley Power- plant	Slurry Pipeline	Warner Valley Water Project		
1985						
Employment	922	100	10	0	1,212	2,244
Income	13,949.9	^a 2,326.5	a	a	13,021.9	29,298.3
1990						
Employment	0	100	10	3	458	571
Income	0	^a 2,638.7	a	a	5,814.6	8,453.3
1995						
Employment	0	100	10	3	529	642
Income	0	^a 2,913.4	a	a	6,711.8	9,625.2
2000						
Employment	0	100	10	3	553	666
Income	0	^a 3,216.5	a	a	7,794.1	11,010.6

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aIncomes for Operating Personnel are not broken out by category.

Employment sectors most markedly affected by these increases would be construction (temporarily), utilities, trade, services, and government (table 1-2 in Appendix 17). Over the long term, utilities, trade, services, and government would be the sectors most benefitted by the project. The above increases in employment would also be felt in increased earnings in the county, especially through 1985. Total increased earnings (both direct and indirect) would be estimated to total nearly \$30 million (in 1977 dollars). After the construction period, added project related incomes would be estimated to level off to about \$8.5 million per year and eventually rise to a little over \$11 million per year.

Services. The impacts of this alternative on basic services in Washington County would be significant. Project oriented impacts would be most concentrated in the St. George area, but would also affect other communities such as those in the Hurricane area. As with Kane County, the most pronounced impacts would occur during the initial growth period of 1980-1985, and would then stabilize at more normal levels. Fire protection and water supplies would tend to be the least affected services in the county, while police protection and education are already near or at their capacities and would have to be substantially expanded to accommodate increased populations. Other problem areas would include sewage disposal countywide, but especially in the Hurricane area where an existing and chronic problem would probably reach the breakdown point. The table below summarizes the points in time that the capacities of existing services or those currently under construction would be exceeded by combined baseline and project-related population increases. The information is a composite of more detailed data contained in Appendixes 11 and 17.

<u>Community</u>	<u>Law Enforce- ment Needs</u>	<u>Fire Protec- tion Needs</u>	<u>Water Supply Needs</u>	<u>Sewage Treatment Capacity Needs</u>	<u>School Staff Needs</u>	<u>Health Care Facility Needs</u>
Washington County	...	...	...	...	a	...
Hurricane	a	b	b	b	...	a
Ivins	a	a	b	a	...	a
LaVerkin	a	a	b	b	...	a
Leeds	b	a	b	b	...	a
St. George	a	1980- 1985	b	1980- 1985	...	a
Santa Clara	a	1980- 1985	b	1980- 1985	...	a
Toquerville	a	a	b	b	...	a
Washington	a	a	b	a	...	a

Source: BLM, see Appendixes 11 and 17

^aExisting facilities or staffing already at or near capacity.

^bExisting capacities not projected to be exceeded before the year 2000.

Tax Base. With an anticipated project property value of around \$391.5 million for Washington County components, the Washington County tax base could be expanded by as much as \$50.7 million in assessed value (assuming an assessment rate of 12.96 percent of market value). In turn, this would result in an increase in annual property tax revenues of around \$4 million (assuming a mill levy of 78 mills as cited in Utah Industrial Development Division, 1978). Although such revenues would be extremely beneficial to the county over the long term, it is not likely that they would be available in time to help offset impacts anticipated for the initial construction phase of the project, when the most significant impacts would occur.

Quality of Life. The initial stages of this alternative would precipitate localized infrastructural problems in the county. Although the project components in the county would generate substantial increases in tax revenues, it would be unlikely that such funds would be available in time to offset the initial problems that the project would present to local communities unless special arrangements such as tax prepayments could be made. Over the long term such problems would be reduced and more normal living conditions would be resumed.

Conclusion. This alternative would provide Washington County with additional population and economic growth, although the growth during the construction period could generate some housing and sewage disposal problems in some of the affected communities. Expansion of the county's tax base should eventually relieve such problems, although some short-term deficiencies would probably be incurred.

Impacts to Clark County and Its Communities

Project components which would directly affect the county and its communities would be: the 2,000-MW coal-fired powerplant at the Harry Allen site; the AWT plant; the coal slurry pipeline; and the electrical transmission system.

Population. Increases in population during the construction phase in the Las Vegas Valley area would be expected to rise above baseline levels by about 9,000 persons. This figure includes construction workers and their families and additional secondary employment. Incremental population changes during the operational phase would be around 1,000 to 1,500 persons. In total, the incremental change would be less than 2 percent over the baseline and would not be likely to generate significant negative impacts in the Las Vegas Valley area. These impacts are projected in table 1-1 of Appendix 17 through the year 2000. The information below shows the anticipated population changes for the initial 5-year period during which the most significant impacts would be expected to occur:

<u>Community</u>	<u>1980 Baseline</u>	<u>1985 Baseline Pro- jection</u>	<u>Popu- lation with Project (1985)</u>	<u>Increment Due to Project</u>	<u>Percent Annual Compound Growth</u>	
					<u>Without Project</u>	<u>With Project</u>
Las Vegas Valley	474,485	578,614	587,390	8,776	4.05	4.36

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

Employment and Income. The table below shows the projected employment (number of jobs) and income impacts of this alternative throughout Clark County.

	<u>Temporary Con- struction</u>	<u>Operating Personnel Harry Allen Powerplant</u>	<u>Indirect Impacts</u>	<u>Total</u>
<u>1985</u>				
Employment	1,566	55	2,610	4,231
Income	35,083.1	1,174.5	38,531.5	74,789.1
<u>1990</u>				
Employment	0	219	442	661
Income	0	5,163.4	7,189.6	12,353.1
<u>1995</u>				
Employment	0	219	447	696
Income	0	5,700.6	8,586.9	14,287.5
<u>2000</u>				
Employment	0	219	490	709
Income	0	6,347.1	9,745.1	16,092.2

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

Services. With existing relatively high population growth rates in the Las Vegas Valley area, any added influence by this alternative on area growth would probably not be distinguishable from the existing trends. This conclusion is drawn from two major points. First, at the maximum, the area population would be increased by only 1 to 2 percent above current rates of growth under this alternative and then only temporarily during the construction phase. This could act to aggravate any existing problems to some extent but would not be likely to generate new ones. The second condition is that population projections used to estimate impacts were based on the assumption that impacts would be in terms of new populations moving into the area to fill the project created jobs. The more probable occurrence however, would be that many of these jobs would be filled from within the Las Vegas area labor pool and might not then result in additional inflows of people.

From these two points of view the conclusion would be that impacts directly attributable to this alternative would be minimal on the abilities of Las Vegas Valley municipalities to provide basic services. The following table summarizes the points in time that the capacities of existing services or those currently under construction would be exceeded by combined baseline and project-related population increases. The information is a composite of more detailed data contained in Appendixes 11 to 17.

<u>Community</u>	<u>Law Enforce- ment Needs</u>	<u>Fire Protec- tion Needs</u>	<u>Water Supply Needs</u>	<u>Sewage Treatment Capacity Needs</u>	<u>School Staff Needs</u>	<u>Health Care Facility Needs</u>
<u>Clark County</u>						
Las Vegas Valley	a	1985- 1990	1995- 2000	a	a	a

Source: BLM, see Appendixes 10 and 17.

^aExisting facilities or staffing already at or near capacity.

Tax Base. This alternative would have the effect of increasing the assessed valuation of the Clark County property tax base by approximately \$486,720,000, or an estimated \$10.96 million in increased tax revenues (assuming a levy of 2.2527 per \$100 of assessed value). A portion of these revenues would, of course, be required to provide services for increases in population brought about by the project. However, it would be anticipated that a significant residual amount above and beyond that required to expand services would be left over.

Quality of Life. The basic character of the Las Vegas Valley area, dominated by the gaming and entertainment industry, would not be significantly affected by this alternative. It would be possible that some existing infrastructural problems in the area could be aggravated by projected population increases, but probably not to a significant degree. On the whole, it would not be anticipated that the quality of life in the Las Vegas Valley area would be markedly changed by this alternative.

Conclusion. Since high population growth rates already exist in the Las Vegas Valley area and since there is a large diversity in employment and business activity, this alternative would not generate much impact on existing trends. The greatest impacts would occur during the construction phase of the project, but these would only yield a 1 or 2-percent increase over baseline projections and could usually be absorbed by the area quite readily. The increased tax base could be extremely beneficial, especially in view of the low level of incremental impacts on existing services that would be generated by the project.

Impacts to the Electrical Transmission System Regions

Studies addressing the impacts of the AWV and similar transmission systems (NPC, 1975; IPP, 1979; and SCE and PG&E, 1979) generally conclude that no lasting negative socioeconomic impacts would occur in Utah, Nevada, or California as a result of either the construction or operation of any of the possible transmission system routings. Most impacts would be of a very temporary nature and would be concentrated in the construction phase. These would consist of some shortages of lodging accommodations as work crews pass the various towns along the transmission line routes. It would be unlikely for such conditions to persist longer than 2 to 3 months. During such time, the affected communities would receive a temporary economic infusion in the form of purchases of food, lodging, and other services by the work crews. The basic workforce needed for construction of each route would be:

	<u>I-15</u>	<u>Eldorado - Lugo</u>	<u>Victorville - McCullough</u>	<u>Route 66</u>
Road	20	22	21	28
Foundation	73	77	75	99
Tower Erection/ Conductor Stringing	403	426	412	547
General	<u>21</u>	<u>22</u>	<u>21</u>	<u>28</u>
TOTAL	517	547	529	702

Source: SCE and PG&E, 1979

The incomes generated by this employment have been projected by the project proponents at the following amounts:

<u>Type of Employment</u>	<u>In Thousands of 1979 Dollars</u>			
	<u>I-15</u>	<u>Eldorado - Lugo</u>	<u>Victorville - McCullough</u>	<u>Route 66</u>
Roads	\$ 467	\$ 514	\$ 486	\$ 654
Foundation	2,200	2,321	2,261	2,984
Tower Erection/ Conductor Stringing	12,662	13,385	12,945	17,187
General	<u>1,155</u>	<u>1,211</u>	<u>1,155</u>	<u>1,541</u>
Total	\$16,484	\$17,431	\$16,847	\$22,366

Source: SCE and PG&E, 1979

Permanent operating crews would have a projected total income of \$60,000 per year.

Long-term impacts would generally be derived from property tax revenues generated by the transmission system. Total estimated property tax revenues per year in constant 1979 dollars would be:

	<u>I-15</u>	<u>Eldorado - Lugo</u>	<u>Victorville - McCullough</u>	<u>Route 66</u>
Annual Property	\$835,000	\$873,000	\$883,000	\$1,016,000

Source: SCE and PG&E, 1979

These tax revenues would be spread over the entire lengths of the alternative routings and would not go to any one locality. However, with the majority of route lengths being in California, the vast proportion of these revenues would accrue there. Operational workforces would be expected to be only six

persons working part-time and would therefore not be likely to generate any socioeconomic impacts of consequence.

Coal Resources

A total of 312 million tons of coal would be mined, processed, and consumed over the life of the project. The coal would be unavailable for future procurement and consumption.

Energy Efficiency

This alternative would provide for an average output of 1,750 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) into another form (electricity). The energy efficiency of this alternative was computed by converting the various qualities and quantities of resource inputs into their energy equivalents, expressed in Btu per year. The energy equivalents were derived for all resources required for the development of this alternative, including: capitalizations, operating and maintenance costs, materials, manpower, transportation, and fuels (including coal). Energy values contained in the coals were derived from approximate analyses of coals within the Alton coal lease area. Energy required in coal mining was developed from unpublished data collected in the preparation of SU (1979). Insofar as practical, data furnished by the applicants was used. All converted resource values (energy equivalents) were consolidated into a single expression of the average annual input of energy (Appendix 19). This figure was then compared to the output of energy that would be generated from the Harry Allen and Warner Valley powerplants as would be measured at the Lugo and Pecos substations (assuming transmission line losses).

The energy efficiency of this alternative would be 22.1 percent.

Coal-fired generating capacity (1,750 MW) equal to approximately 17.5 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the consumer would benefit from a more stable electricity costs structure.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation of this alternative are presented in table 4-7. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative and an examination of the relationship between the short-term uses of those resources and the maintenance and enhancement of long-term productivity.

TABLE 4-7

ALTERNATIVE 1: Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-term Use of Environment (40-Year Project Life)		Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Yes	No	Yes	No	
Air Quality	Air quality degraded by emission of the following pollutants: Harry Allen Powerplant - 40.8 tons per day of SO ₂ , 8.16 tons per day of particulate matter, 136.22 tons per day of NO _x . Warner Valley Powerplant & 10.38 tons per day of SO ₂ , 34.30 tons per day of NO _x , and 2.04 tons per day of particulate matter.	Yes	No	No	No	Yes	No	Emissions would ultimately be dispersed and eventually removed naturally from the atmosphere by wet and dry deposition.
	The 24-hour PSD Class I increment for SO ₂ exceeded at Zion National Park. PSD Class II 3-hour, 24-hour, and annual SO ₂ increments exceeded near Harry Allen powerplant. The 3-hour and 24-hour SO ₂ , 24-hour and annual TSP and annual NO _x NAAQS exceeded near the Harry Allen powerplant site. Possible impacts to visibility at Zion National Park from the Warner Valley powerplant. Dust plumes from mining activity at Alton visible from Yovimpa Point in Bryce Canyon National Park.	Yes	No	No	No	Yes	No	See above.
	Brown haze visible in the vicinity of both powerplants under certain meteorological conditions. Cooling tower plumes also visible at certain times.	Yes	No	No	No	Yes	No	See above.
Water Resources	Loss of up to 10,000 acre-feet per year from pumping of ground water from the Navajo Sandstone aquifer for use as coal slurry. Possible reductions in well and spring yields in adjacent valleys as a result of ground water pumping of the Navajo Sandstone aquifer near Bald Knoll for coal slurry.	Yes	No	No	No	Yes	Project life and beyond	Recharge of the aquifer would require an unknown period of time after project life. See above; contamination and sedimentation of surface streams would continue for an unknown period of time after project life.
	Loss of natural flow in as many as 20 local springs and possible contamination and sedimentation of surface streams due to surface strip mining in the Alton coal lease area. Reduction in flows of Virgin River of 37,700 acre-feet per year at the Warner Valley water project diversion.	Yes	No	No	No	Project life and beyond	Project life and beyond	Water project diversions would continue for an unknown number of years after the short term (more than 100 years), as projected community growth would utilize continually larger quantities of water.

(continued)

TABLE 4-7 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Irreversible	Retrievable		
Vegetation Species of Concern	Warner Valley diversion preclusion of up to 37,000 acre-feet of water per year from downstream use.	Yes	No	Project life and beyond	Project life and beyond	Project life and beyond	See above.
	Consumptive use of up to 22,600 acre-feet of water per year for municipal, industrial, and irrigation uses (Warner Valley water project).	Yes	No	Project life and beyond	Project life and beyond	Project life and beyond	See above.
	Increased salinity concentration by approximately 175 mg/l in the Virgin River as a result of Warner Valley water project diversion.	Yes	No	Project life and beyond	Project life and beyond	Project life and beyond	See above.
	Consumptive use of up to 10,000 acre-feet of water per year at Warner Valley powerplant.	Yes	No	Project life	Project life	Yes	Water lost to evaporation in power generation process would be eventually returned via hydrologic cycle.
	Consumptive use of an average 27,443 acre-feet of water (effluent) per year from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	Project life	Project life	Yes	See above; effluent transferred from treatment plant would be made up with increasing community growth and related increase in effluent.
Wildlife Species of Concern	Increase in flood depth in Dry Lake Playa with operation of flood control dikes around Harry Allen powerplant and facilities.	Yes	No	No	No	Yes	Flood levels would drop to natural levels with dismantling of powerplant and dikes.
	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Loss of a population of the endangered bear-claw poppy (<i>Arctomecon humilis</i>) related to the construction and operation of the Warner Valley powerplant and water project.	Yes	Yes	Yes	Yes	Yes	Loss of this population could lead to the extinction of the species.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Construction and operation of coal slurry pipeline and electrical transmission system disturbing up to 12,684 acres of habitat of the desert tortoise (<i>Gopherus agassizii</i>), a species threatened in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Unknown	Yes	See above.

(continued)

TABLE 4-7 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)		Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Yes	No	Yes	No	
Cultural Resources	Reduction of habitat of the endangered roundfin minnow (<i>Platypharodon argenteus</i>) and the rare Virgin River roundtail chub (<i>Gila robusta seminuda</i>) with the diversion of Virgin River for the Warner Valley water project.	Yes	Unknown	Yes	Unknown	Project life and beyond		Diversion at proposed rate would reduce habitat and subsequently the numbers of these fishes, jeopardizing their continued existence.
	Adverse impact up to an estimated 348 archaeological sites with the construction of the various project components.	Yes	Yes	Yes	Yes	Yes		Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impacts to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Unknown	Yes		Placement of the microwave station could permanently disgrace the sacredness of the mountain.
	Destruction of the Hurricane Canal/Diversion physical structure (currently listed on the National Register) with the construction of the Warner Valley water project diversion structure and canal system.	Yes	Yes	Yes	Yes	Project life and beyond		Physical loss of this antiquity would be permanent.
	Impact to the natural setting of the Honey-moon Trail (currently nominated for inclusion on the National Register) with the construction and operation of the coal slurry pipeline and ancillary facilities.	Yes	No	No	No	Yes		Construction and operation of pipeline and ancillary facilities would alter the natural character of the trail until project would be decommissioned.
Recreation and Aesthetics	Impact of construction of Warner Valley powerplant on adjacent portions of the Dominguez-Escalante Trail (being studied by NPS for inclusion in the National Historic and Scenic Trail System), the Honeymoon Trail (nominated for inclusion on the National Register), and the historic Temple Trail.	Yes	No	No	No	Project life	Yes	Character and use of trails would be impacted along affected portions for the life of the project. After decommissioning, some construction scars would permanently alter natural character of the trails.
	Adverse impact to the scenic character of the St. George Basin, Zion National Park, and Dry Lake, Nevada when visibility reduced by concentrations of stack emissions from Warner Valley and Harry Allen powerplants; also adverse impacts to local aesthetic and recreational resources.	Yes	No	No	No	Project life	Yes	Emissions would ultimately be dispersed and removed naturally in the atmosphere.
	Approximately 1,550 of the visual resource as viewed from Yovimpa Point in Bryce Canyon National Park degraded with strip mining activities at the Alton East coal lease area.	Yes	Unknown	Unknown	Unknown	Yes		Portions of the visual resource could be permanently altered even after reclamation.

(continued)

TABLE 4-7 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Irretrievable		
Wilderness	Noise generated during mining activities (including blasting) in the Alton coal lease area would impact recreation and aesthetics values at Bryce Canyon National Park. Blasting could be perceived as being 64 times louder and truck noise 2 to 16 times louder than natural background levels.	Yes	No	Project life	Yes	Noise pollution would cease with the termination of mining activities.
	Decrease in the value of the park experience in Bryce Canyon National Park as perceived by approximately 20 percent of park visitors.	Yes	No	No	Project life and beyond	The value of the park experience would be decreased until after mining activities would be terminated and affected lands reclaimed.
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
Land Use	Violation of BLM Wilderness Study Areas in southern California with placement of three of four alternative routes of the Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
	Change from present land uses to project uses on 24,752 acres.	Not applicable	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Kane, Washington, and Clark Counties for those areas to be occupied by the Alton coal mine, Warner Valley powerplant, and Harry Allen powerplant respectively. Zoning change in city of Henderson, Nevada for transmission corridor.	Not applicable	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Change in zoning in Washington County for area to be occupied by Warner Valley water project.	Not applicable	Yes	Yes	Project life and beyond	Water project would be considered a permanent fixture on the landscape.
	Intrusion on trust lands of Moapa Band-Paiute Indians (if awarded by Congress) with construction and operation of the coal slurry pipeline and transmission system.	Yes	No	No	Yes	Granting of rights-of-way would be subject to tribal authority.

(continued)

TABLE 4-7 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Irreversible	Retrievable		
Socio- economics	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in Kane and parts of Washington Counties. Quality of life adversely affected.	Yes	No	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be exper- ienced in some areas.
Coal Resources	A total of 312 million tons of coal mined at the Alton coal lease area and consumed.	Yes	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

NOTE: SO₂ = Sulfur Dioxide
 PSD = Prevention of Significant Deterioration
 TSP = Total Suspended Particulates
 NO_x = Nitrogen Oxides
 NAAQS = National Ambient Air Quality Standards

ALTERNATIVE 2: IMPACTS OF MAJOR CONCERN

The implementation of this alternative would involve the following major components which are analyzed according to their significant impacts to the environment: coal mining in the Alton coal lease area of southwestern Utah; construction and operation of a pipeline to slurry pulverized coal from the Alton coal preparation plant to the Harry Allen powerplant at Dry Lake, Nevada; the construction and operation of a 2,000-MW powerplant at the Harry Allen site in Dry Lake, Nevada; and the construction of a transmission system to send electricity from the Harry Allen powerplant to the service areas of NPC, SCE, and PG&E.

For analysis purposes it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from participants of the Intermountain Power Project.

Air Quality

This alternative must comply with the applicable State and Federal air quality standards and regulations as shown in table 4-1.

Coal Mining in the Alton Coal Lease Area

Impacts to air quality and visibility from the Alton coal mine under this alternative would be similar in type to impacts described in Alternative 1, although slightly less in magnitude due to the lower coal production rate.

Construction and Operation of the 2,000-MW Harry Allen Powerplant

The following stack emissions would be expected for a 2,000-MW Harry Allen powerplant burning Alton coal:

	<u>Harry Allen Plant</u> (tons per day)
SO ₂	40.80
Particulate matter	8.16
NO _x	136.22

Particulate Matter. As shown in table 4-8, initial studies by EPA Region IX indicate that the Harry Allen powerplant would exceed the PSD Class II increments for particulate matter.

Sulfur Dioxide (SO₂). Initial studies by EPA Region IX indicate that emissions of SO₂ from the Harry Allen powerplant would cause the PSD Class II SO₂ increments and the NAAQS to be exceeded (EPA, 1979). These estimates were made using the EPA Valley model. On May 19, 1980, NPC submitted the results of a plume tracer study done by Meteorology Research, Incorporated to EPA Region IX. EPA Region IX met with NPC on October 2, 1980 to review the tracer study and model validation studies of NPC. EPA has approved the SAI CTGM model for assessment of the air quality impacts from the Harry Allen powerplant subject to certain conditions (personal communication, Thomas A. Cramer, Chief Permits Development Section, EPA Region IX, to John Arlidge, NPC, October 10, 1980). NPC will submit their results to EPA

along with additional BACT information requested by EPA. A determination of application completeness will be made by EPA within 30 days of the submission of material and it is possible that a preliminary position on permit approval or denial could be made within the same timeframe. PSD increments in the potential Class I area of the Paiute Primitive Area would not be violated (Radian, 1980). The Class II increments in the Valley of Fire State Park would not be exceeded (Radian, 1980). Concentration estimates (noncumulative) are presented in table 4-8.

Nitrogen Oxides (NO_x). Initial studies by EPA Region IX indicate that emissions of NO_x from the Harry Allen powerplant would cause violations of the NAAQS (table 4-8). There are no PSD regulations pertaining to NO_x at this time, but the impacts on atmospheric discoloration and visibility caused by NO_2 emissions would be regulated in Class I areas. These impacts are discussed in the Visibility section of this alternative.

Ozone (O_3 , Photochemical Oxidants). As noted in Alternative 1, the plume from the Harry Allen powerplant would not be expected to cause or contribute to NAAQS violations for O_3 in the Las Vegas Valley (Radian, 1980).

Plume Opacity. Federal NSPS for particulate matter (Federal Register, Volume 44, Number 113) specify a limitation of 20-percent plume opacity at the stack exit. Particulate concentrations of fly ash from the stack would be about 0.012 grains per actual cubic foot (0.027 grams per cubic meter) assuming maximum load, use of worst grade coal, and an electrostatic precipitator operating at 99.5-percent efficiency.

Under normal operating conditions the plume from the proposed Harry Allen powerplant would be barely visible at the stack. However, during startup operations before the electrostatic precipitators would be able to reach operating efficiency, and during upset conditions, the plume could be highly visible.

Trace Elements. The pathways of distribution of trace elements and the long-term accumulation effects are not well known. Generally, calculated concentrations would be below measured background levels (NPC, 1975) and would not be considered significant over the life of the project (tables 1, 2, 3, and 4 of Appendix 13). The emission control and monitoring of trace element releases from the Harry Allen powerplant are discussed in Alternative 1.

The USFWS biological opinion of 1978 (USDI, USFWS, "Formal Consultation," 1978) specifies a concern about possible toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed powerplant site. BLM lease stipulations would require compliance with State and Federal monitoring requirements (Standard Operating Procedures, Appendix 6).

Radioactive Nuclides. Radioactive materials are present in any coal and certain amounts of radioactive nuclides would be emitted from the stack. Maximum ground level exposure from the Harry Allen powerplant emissions would fall well below the standards for general public exposure set by the Atomic Energy Commission (now U.S. Department of Energy) and therefore,

TABLE 4-8

Estimated Air Quality Impacts Due to Emissions from the
Proposed 2,000-MW Harry Allen Powerplant

Harry Allen Powerplant	Estimated Concentration ($\mu\text{g}/\text{m}^3$)					
	Sulfur Dioxide (SO_2)			Particulate Matter (TSP)		Nitrogen Oxide (NO_x)
	Annual	24-Hour	3-Hour	Annual	24-Hour	Annual ^x
Class II EPA Reg. IX ^a	44.0	94(A) 347(E) 622(F)	 1,388(E) 2,488(F)	38.0	101.0	103.5
EPA Reg. IX ^b	.....	.....	.....	72.0	191.0	74.1
ERT ^c	2.9	21.4	250.9	0.3	1.9	13.6
Bechtel ^d	2.0	92.0	307.0	0.9	9.3	9.8
Valley of Fire State Park Radian ^e	2.3	16.6	130.0	0.5	3.3	NC
PSD Standard	20.0	91.0	512.0	19.0	37.0	.....
NAAQS Standard	80.0	365.0	1,300.0	75 (60)	260 (150)	100.0
Class I Paiute Primitive Area (Potential Class I Area Only) Radian ^e	<2.0	<0.2	<1.0	<5.0	<10.0	NC
PSD Standard	2.0	5.0	25.0	5.0	10.0	.....

Sources:

^a Modeling summary from EPA Region IX, November 1979 assuming an emission rate of 1.7 tons per hour SO_2 , 0.18 ton per hour TSP, and 190 tons per day NO_x .

^b EPA Region IX results adjusted to an emission rate of 1.7 tons per hour SO_2 , 0.34 ton per hour TSP, and 136 tons per day NO_x .

^c ERT, Analysis for Harry Allen, 1977.

^d NPC, 1975.

^e Studies for BLM by Radian Corporation, 1980.

NC = Not calculated

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

(A) = Stability Class A, high unstable

(E) = Stability Class E, slightly stable

(F) = Stability Class F, moderately stable

NOTE: All concentrations in this table (except those noted in a) have been adjusted to reflect an emission rate of 1.7 tons per hour SO_2 , 0.34 ton per hour TSP, and 136 tons per day NO_x .

would not be considered significant in the short term (NPC, 1975). The impact of low level exposure over long periods of time is not known.

Condensed Water Plumes. Condensation of water vapor emitted from the powerplant stacks and cooling towers would produce a visible plume for a distance downwind from the powerplant. The stack plume from the Harry Allen powerplant would be visible for more than 400 feet approximately 30 percent of the time (NPC, 1975). Depending on the number of units in operation, plumes longer than 1 mile would be visible between 1 and 5 percent of the time. Cooling tower plumes longer than 100 feet downwind would occur about 22 percent of the time. Plumes longer than 1,000 feet would occur about 1 percent of the time. The height of the visible cooling tower plume would exceed 500 feet less than 20 percent of the time and would exceed 1,000 feet less than 1 percent of the time. Because of the distance from major roads, the direction of prevailing winds, and the arid climate, any impacts to motorists from icing and fogging of highways by the cooling tower plumes from the Harry Allen powerplant would be considered minimal.

Secondary Pollutants. The major impact from the formation of secondary pollutants (sulfates and nitrates) would be visibility impairment. The impacts of the Harry Allen powerplant on visibility are discussed in the following section.

Visibility. Visibility impacts from powerplant plumes are caused by particulates (fly ash), secondary pollutants (sulfates, nitrates), water vapor, and NO_2 . These impacts would generally be in the form of reductions in visual range and visibility of the plume itself (plume blight).

A significant visibility impairment has been defined by EPA as "... visibility impairment which in the judgement of the administrator, compromises the values of the mandatory Class I area" (EPA proposed visibility regulations, 40 CFR, Part 51). It is the policy of NPS to protect the scenic values of Class I areas from any adverse visual impairment at human levels of perception (letter from William J. Whalen, Director NPS, to David Hawkins, EPA, Assistant Administrator, Air, Noise, Radiation, April 1979).

Visibility impacts from the Harry Allen powerplant would be the same as those described in Alternative 1. A visible brown haze could be expected from the Harry Allen powerplant plume under certain atmospheric conditions due to NO_2 discoloration of the atmosphere.

Cumulative Impacts. The applicants must demonstrate that the impacts of the Harry Allen powerplant, in combination with any other local sources of air pollution, would meet applicable State of Nevada and Federal air quality standards and regulations before a PSD permit or construction permit could be issued.

Population Growth. The increased levels of pollution from population growth associated with the Harry Allen powerplant would not be expected to exceed State and Federal air quality standards and regulations.

Nonattainment Area of Las Vegas. The impacts of the Harry Allen powerplant on ambient concentrations of total suspended particulates and CO in the Las Vegas nonattainment area would be expected to be minor (less than

the values identified by EPA as significant). Significance values have not been established for O_3 . However, an evaluation of meteorological conditions associated with historically high O_3 episodes, and a comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_x (O_3 precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area, indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Construction and Operation of the Alton Coal Preparation Plant and Pipeline

No significant impacts would result from these components.

Water Resources

The major components of this alternative which would affect water resources would be: coal mining in the Alton coal lease area; and the Harry Allen powerplant in Dry Lake, Nevada. Impacts of coal mining in the Alton lease area are discussed in Alternative 1 of this chapter. The major impact areas would include reduction or elimination of springflow as a result of surface mining and disturbance of shallow ground water aquifers, ground water pumping for coal slurry from the Navajo Sandstone and its effects on existing and potential water rights, surface water contamination from mine wastes, and increased sedimentation on 10,154 acres of land to be disturbed by mining. Up to 20 springs in their present location and condition (totalling between 100 and 150 acre-feet of water annually) would be altered by mining activities, depending on actual mine locations and methods (mining plan). Also, yields of wells and springs in adjacent valleys could be adversely affected by ground water pumping. Impacts due to these alterations are not presently known and would need to be specifically investigated when an updated mining plan would be submitted and aquifer test results are available from UII.

Mining backfill may contaminate shallow aquifer water quality locally by increasing ground water salinity. The extent of this contamination should be restricted to the area of the mine because both the backfill and present aquifer characteristics appear to be poor (SU, USDI, USGS, 1979; Hydrologic Evaluation, USDI, USGS, 1979). No significant changes in ground water discharge to surface streams (base flow) would be expected (Goode, 1980).

Accelerated erosion in mining areas could cause an increase in sedimentation in Kanab, Thompson, and Skutumpah Creeks; and Meadow Canyon Wash, but the extent cannot be quantified at this time due to insufficient data.

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant along with the necessary diversion dikes and storage and settling ponds would reduce the surface area of the Dry Lake playa by 1,850 acres. This would elevate flood levels of a potential 50-year flood by 8.5 feet above the present natural ponding elevation. This could result in increased maintenance problems for the existing transmission lines located along the eastern end of the playa. Flooding of the old highway frontage road (and access to the town of Dry Lake) should be eliminated by construction of the proposed flood control structures.

No significant impacts would be expected from the transfer of an average of 24.5 mgd of effluent from the Clark County AWT plant to the powerplant. See Alternative 1 for additional discussion.

Wetlands and Floodplains

As noted under Alternative 1, the major areas of concern would be the possible coal development effects on wetlands and floodplains, and the proposal to locate the Harry Allen powerplant within the 50-year floodplain of the Dry Lake playa. The U.S. Army Corps of Engineers will determine the potential impacts of the 100-year flood at the Dry Lake site before the final design of the powerplant would be completed. Approximately 1,860 acres would be removed from the existing playa. UII is presently conducting a baseline hydrologic inventory of the Alton coal lease area. Information on flooding potential, and mapping and a physical description of all lease area drainage basins and appropriate drainage facilities will be developed. The information will be provided to OSM for their consideration in the current unsuitability evaluation of the Alton coal lease area.

Vegetation: Species of Concern

Several vegetation species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 7). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Their recommendations for mitigating impacts to vegetation is in the Technical Assistance Report in Appendix 15.

Alton Coal Lease Area

NPS has expressed concern that revegetation of coal-mined lands south of Bryce Canyon National Park could introduce plants not native to the area. Should this occur, it would be possible that these introduced plant species could eventually become established within the park, thereby further altering its natural character.

Coal Slurry Pipeline

According to a biological assessment prepared by BLM (1980), two officially listed endangered plant species, the dwarf bearclaw poppy (Arctomecon humilis) and the siler pincushion cactus (Pediocactus sileri) would be adversely affected by the construction of the coal slurry pipeline near the city of St. George. The assessment indicates that while individual plants may be destroyed, neither species as a whole would be significantly affected. The USFWS biological opinion supports this analysis.

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States

of Utah, Arizona, Nevada, and California (Appendix 8). Although not expected to be great, the significance, duration, and character of possible impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Their recommendations for mitigating impacts to wildlife are in the Technical Assistance Report (Appendix 15).

Coal Slurry Pipeline, Electrical Transmission System

The desert tortoise (Gopherus agassizii) was recently listed as threatened in Utah and is protected in the States of Arizona, Nevada, and California. A biological assessment prepared by BLM (1980) and a biological opinion prepared by USFWS (July 1980) indicate that impacts to the tortoise populations in Utah would not be significant because routes proposed for the construction of the slurry pipelines and transmission lines would lie essentially south of an area listed as critical habitat by USFWS. Individual desert tortoise could be adversely impacted on as many as 10,915 acres of habitat during the construction of the coal slurry pipeline and transmission system as a result of vehicle collision and human capture. The result could be reductions in local populations, but these would not be significant.

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. It is assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register caliber under the criteria that they ". . . have yielded, or may be likely to yield, information important in prehistory . . ." (36 CFR, Part 60).

Should an alternative be approved, full and complete inventories would be accomplished according to Standard Operating Procedures (Appendix 6), in accordance with the action plan for compliance with the Advisory Council of Historic Preservation procedures for the protection of historic and cultural resources (Appendix 9), and by the provisions of the "Memorandums of Understanding" developed with the SHPOs involved in the project (Appendix 9).

Alton Coal Lease Area

Based on the average site density of one site per 43 acres, an estimated 236 sites would be adversely impacted during mining activities on 10,154 acres at the Alton coal lease area. Of the total sites, 236 at least 177 would probably be of National Register caliber. Increased population pressure could lead to increased vandalism of some local sites. No significant historical properties are presently known in the Alton coal lease area.

Coal Slurry Pipeline

According to Fowler (Volume 3, 1975), 53 archaeological sites were encountered within or adjacent to the pipeline study corridor. An estimated 15 of these sites would be adversely impacted by construction activities. At

least 12 of these sites would probably be of National Register caliber. An inestimable number of unknown (buried) sites could also be impacted. A 1,000-acre easement for maintenance access would be maintained throughout the life of the project. The balance of archaeological sites would be subject to secondary adverse impacts of vandalism because of increased access to the sites.

Construction of the slurryline would temporarily impact visitation to the Fort Pierce National Register Property, which lies just 0.25-mile south of the proposed route in Warner Valley (fig. 2-4). It is assumed that no further impact would occur after construction because the site was recently stabilized and upgraded to accommodate substantially more use than what it is presently experiencing.

Construction and operation of the slurryline would indirectly impact the Honeymoon Trail, which is nominated to the National Register (fig. 2-4). The slurryline would be constructed some 1,500 to 4,000 feet north of the Honeymoon Trail as it descends the Hurricane Cliffs. Construction would alter the existing landscape character, leaving some permanent scars adjacent to portions of the trail that lie east of the cliffs from cut and fill operations. The physical remains of the trail would not be harmed. Construction of a microwave station, air strip, and a valve station at the top of the Hurricane Cliffs would adversely impact the existing natural landscape and visual character of the area through which the trail passes.

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Electrical Transmission System

Construction of the transmission system could adversely impact archaeological sites on 9,665 acres of right-of-way. Segments of the transmission system are considered separately because of their geographical distribution.

Spry to Alton. The nature and extent of the cultural resources along the Spry to Alton corridor are poorly known and it is difficult to qualify or quantify significant impacts. However, an estimated 17 sites would be impacted, 13 of which may be of National Register caliber.

Allen to Eldorado. The segment from the Allen plant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would probably be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be adversely impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979).

Interstate 15. An estimated 35 sites would be impacted along this alternative route, 26 of which may be of National Register caliber.

Eldorado - Lugo. An estimated 31 sites would be impacted, 23 of which may be of National Register caliber.

Victorville - McCullough. An estimated 58 sites would be impacted, 44 of which are possibly of National Register caliber.

Highway 66. An estimated 29 sites would be impacted, 22 of which are possibly of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with American Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Alton Coal Lease Area

Normal mining operations in the Alton East coal lease area would be visible from observation points on the southern rim of the Paunsaugunt Plateau, and especially for more than 300,000 annual visitors to Yovimpa Point in Bryce Canyon National Park. There are no developed vistas on the Paunsaugunt Plateau in the Dixie National Forest. Approximately 10 miles of the extreme eastern portion of the Alton East coal lease area would be visible from Yovimpa Point, with active mining visible from as close as 4 miles from this location. No surface mining would be seen from Yovimpa Point until mining progressed to Table Mountain. This would occur about 7 years after the commencement of mining, and active surface mining would be visible from Yovimpa Point for approximately 21 years. Of the approximate 5,250 surface minable acres in Alton East, about 1,500 would be visible (fig. 3-10).

The area of the greatest amount of disturbance distinguishable from the park (mining about 260 acres) would occur at a distance approximately 8 miles from Yovimpa Point, however, active mining would be most noticeable at a distance of 4 miles from this location. Modifications to line, form, color, and textural elements of the pre-existing landscape would occur during mining and the early stages of reclamation. Initially, pinyon-juniper woodlands and stands of big sagebrush would be removed from the area prior to strip mining. While active mining would continue and during the early stages of reclamation, the lease area would be a major intrusion on the landscape as viewed from Yovimpa Point. VRM Classes II, III, and IV in the lease area would be exceeded during mining operations. However, in less than 10 years after successful reclamation, Class III and IV areas management criteria would be satisfied. It has not been determined if VRM Class II objectives would be satisfied after reclamation.

Planned construction at Bryce Canyon National Park in fiscal year 1980 indicates the upgrading of the nature trail and the development of a viewpoint on the Promontory, which is higher in elevation and further east than Yovimpa Point. Mining of the Alton East coal lease area would be a greater visual intrusion from this point.

Strip mining the Alton East lease area as identified in Chapter 2 would conflict with a NPS recommendation to OSM that portions of the Alton East lease area which are adjacent to or visible from Bryce Canyon be declared unsuitable for mining (Recreation and Aesthetics section, Chapter 3; fig. 3-10). This alternative would also conflict with BLM's Management Framework Plan for Coal Management in Zion Planning Unit. Approximately 600 acres of the Alton lease area would be unacceptable for surface mining under BLM's unsuitability criteria (Recreation and Aesthetics section, Chapter 3, fig. 3-10).

In addition to visible effects of mining on the landscape, blasting and noise associated with normal mining operations would impact recreational and aesthetic values. Blasting (required to remove overburden and coal) would generate dust plumes that would be readily visible from Yovimpa Point. During the peak summer visitor months (June through August) seasonal winds would carry blasting and heavy equipment generated dust toward the park. SAI (1980) estimates that the visibility could be impaired by 5 to 25 percent from mine generated dust when viewing from Yovimpa Point toward the mining area. Visibility reductions could also impair the view of the Grand Staircase.

Studies conducted in conjunction with SUPED (USDI, OSM, 1980) have indicated that vibrations associated with blasting would not have an adverse impact on the erosional forms of Bryce Canyon National Park or Dixie National Forest.

Surface mining noise generated in the Alton coal lease area would be distinctly audible in Bryce Canyon National Park, with the most serious impact occurring at Yovimpa Point. Noise from mining the Alton West area would also be audible in the park. Surface mining noise would generally come from two sources: coal trucks and blasting coal. Trucks in the Alton East area would produce maximum noise levels from 28 to 59 decibels at Yovimpa Point. This would cause an increase of two to sixteen times the currently perceived noise levels. Truck noise would be continuous and would be perceived as a droning at various levels (Foch and Oliver, 1980).

Blasting noise from the Alton East lease area would be as high as 86 decibels at Yovimpa Point and could occur two to six times a day. Blasting noise could be perceived as being 64 times louder than current background noise levels (Foch and Oliver, 1980).

A visitor survey was conducted at Bryce Canyon National Park by NPS in the summer of 1980 in order to assess the effects that mining activities would have on the visitors' perception of park values. The park values which were considered most important to visitor enjoyment were the scenic views, intricate rock formations, natural forest, wildlife, solitude, and clean air. Seventy-six percent of the survey respondents that visited Yovimpa Point indicated their primary purpose for visiting the viewpoint was the vista. Based on NPS projections for the year 2004, from 799,315 to 1,446,810 people will visit Bryce Canyon National Park annually. According to NPS, strip mining activities would decrease the value of visits for approximately 20 percent of the annual visitors for the 21 years of visible mining. Ten percent of the annual visitors would spend less time at Yovimpa Point, and 7 percent of the annual visitors would spend less time at the park for the 21

years of visible mining. The survey concluded that for the duration of visible mining (21 years) 2 percent of annual visitors would not want to visit Yovimpa Point and 1 percent of annual visitors would not want to visit the park should mining activities be visible from Yovimpa Point. One percent of the annual visitors would stay longer at Yovimpa Point and the park if mining activities were visible from Yovimpa Point (NPS, 1980).

Based on the NPS survey, it appears that reductions in scenic and air quality resources due to proposed mining activities would decrease the value of the park visitation experience and diminish the time visitors would spend in the park. Although a decrease in the exact number of visits to Bryce Canyon National Park cannot be quantified, a reduction in the amount of time tourists spend in the park would occur. This would result in a loss of revenue for local businesses (motels, restaurants, service stations, etc.) which cater to the tourists, thus impacting the local economy where tourism-related trade is the primary employer (Socioeconomics section, Chapter 3).

Coal Slurry Pipeline

The coal slurry pipeline would generally appear as a linear scar on the landscape. Construction activities would be highly visible, however, in the White Cliffs and Beaver Dam Mountains, where notching and cutting would be required on steep terrain to permit passage of the pipeline. In these areas, VRM Class II objectives would not be satisfied due to the permanent alteration of the natural topography (fig. 3-9). Refer to the same component of Alternative 1 for expected impacts.

Harry Allen Powerplant

The actual presence of the powerplant and powerplant emissions would reduce the quality of visual and recreational resources for sightseers along Interstate Highway 15. The presence of the powerplant and support facilities would not meet VRM Class III objectives (same component, Alternative 1; fig. 4-13).

Electrical Transmission System

The construction of corridor access roads within 9,665 acres of right-of-way would permit increased access to previously inaccessible areas, resulting in an increase in ORV recreational use.

Visual resources would be impacted with the erection of tower structures and transmission lines which would detract from the surrounding scenery for the life of the project. The visual disturbances created by the proposed Spry to Alton, Allen to Eldorado, and Western Transmission System corridors would be identical to those outlined in Alternative 1. The visual impacts created by the proposed Allen to Pecos transmission line are indicated below.

Allen to Pecos. Visual impacts created by the proposed Allen to Pecos transmission line would be minor since this line would parallel the existing Reid-Gardner to Pecos and Navajo-McCullough Corridors (SCE and PG&E, 1979). Placement of the line would, however, further detract from existing scenic quality.

Wilderness

No BLM Wilderness Study Areas or Intensive Wilderness Inventory Units are within the areas designated for the proposed Harry Allen powerplant or the Alton coal lease area. Only the proposed coal slurry pipeline and three of the Western Transmission System alternative routes could impact wilderness values. The impacts to wilderness would be the same as described in Alternative 1 for these components.

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-6. Present land use would be changed on affected acreage during the 40-year life of the project to the project uses indicated below. After decommissioning, these areas would be available for other uses or would revert to pre-existing land uses.

<u>Component</u>	<u>Acreage Affected</u>	<u>Present Land Use</u>	<u>Project Use</u>
Alton Coal Lease Area	8,328	Range, Wildlife	Surface and underground mining of 300 to 400 acres per year
Coal Preparation Plant	1,826	Range, Cropland	Heavy industrial
Harry Allen Powerplant	5,887	Recreation, Wildlife	Heavy industrial
Coal Slurry Pipeline	2,218	Range, Recreation, Wildlife	No change on unfenced right-of-way (temporary impact during construction); 1,000-acre maintained easement
Electrical Transmission System	9,665	Range, Recreation, Wildlife	No change on unfenced right-of-way, (temporary impact during construction); 310 acres of maintained access roads

Alton Coal Lease Area

An analysis of impacts to land use and land use plans and controls is described in SUPED (USDI, OSM, 1980). Lands under coal leases proposed for development are currently zoned such that mining would be restricted or not permitted. Kane County officials are proposing zoning changes which would allow conditional mining on the entire lease area. Further analysis is presented in Alternative 1 for the same component.

Surface mining on approximately 600 acres within the Alton coal lease area would be in conflict with the BLM Management Framework Plan for Coal Management in Zion Planning Unit (fig. 3-10). This acreage is included in

the area of the Alton-Kanab Known Recoverable Coal Resources Area which has been declared unsuitable for mining under BLM unsuitability criteria (Management Framework Plan for Coal, USDI, 1980).

Coal Slurry Pipeline

Conflicts could occur if either one of two bills introduced in Congress to provide trust lands near Moapa, Nevada for the Moapa Band-Paiute Indians would be passed. Rights-of-way would be subject to tribal authority.

Harry Allen Powerplant

Approximately, 5,807 acres of public land and 80 acres of private land would change status (as described in Alternative 1) and would necessitate a zoning change by Clark County officials from the present category of rural open to the heavy industrial category. Routing of the AWT pipeline across portions of Nellis Air Force Base in southern Nevada would require a separate right-of-way.

Electrical Transmission System

The impacts to land use and land use plans and controls of this alternative would be identical to those discussed in Alternative 1 for the same component except that the transmission line from Warner Valley to the Pecos substation would not be constructed. The applicants would have to secure a right-of-way to route the Allen to Pecos line across a portion of Nellis Air Force Base in southern Nevada. The base would grant a right-of-way if the action would not interfere with the mission of the base, and if the action would be for the good of the public.

Should the city council of Henderson, Nevada decide to deny use permits for the routing of the Allen to Eldorado transmission line through the incorporated city limits, the applicants would have to find other corridors for the routing of transmission lines.

The four alternative transmission routes of this system would utilize utility corridors identified in the California Desert Conservation Area Final Environmental Statement and Proposed Plan (USDI, BLM, 1980). The I-15 and Victorville-McCullough transmission routes would occur within planning corridors that have been identified for expansion. Portions of the Highway 66 and Eldorado-Lugo alternative routes would, however, follow "contingent" corridors, and would require a Plan amendment before rights-of-ways could be approved.

The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or potential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through the McCullough Pass in southern Nevada and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routings.

Socioeconomics

Major socioeconomic impacts would include population surges from mine operations at Alton, slurryline and powerplant construction, and transmission lines construction. Such surges would place added demands on services of law enforcement, fire protection, water supplies, sewage disposal, education, and health care, which often cannot readily accommodate rapid expansions.

Impacts to Kane County and Its Communities

The socioeconomic impacts of this alternative on Kane County would be the same as discussed in Alternative 1; significant adverse impacts would result in the areas of infrastructure, services, and the quality of life.

Impacts to Washington County and Its Communities

The project components of this alternative that would affect Washington County and its communities would occur during the construction of the Alton to Harry Allen coal slurryline. There would be a temporary influx of construction workers, but little noticeable socioeconomic impact would be anticipated since current Washington County growth rates (1970 through 1977) have been nearly 6 percent per year (Utah Industrial Development Division, 1978). Also, much of the slurryline work force would originate from the Las Vegas labor pools and many such workers would commute daily from the Las Vegas area, thus reducing local impacts. However, if the peak period workforce would be located in Washington County, it would total around 230, a temporary 1-percent increase in the population which would yield no noticeable permanent socioeconomic effects. Temporary housing shortages could occur in some areas, but would probably be relieved with mobile home or motel type housing. Therefore, Washington County and its communities could be expected to absorb the short-term impacts of construction crews without major disruptions of services in the county.

Impacts to Clark County and Its Communities

The socioeconomic impacts of this alternative in Clark County would be the same as described in Alternative 1; effects would be generally favorable to the local areas.

Coal Resources

A total of 245 million tons of coal would be mined, processed, and consumed over the life of the project. The coal would be unavailable for future procurement and consumption.

Energy Efficiency

This alternative would provide for an average output of 1,400 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) into another form (electricity). The energy efficiency was computed by deriving energy equivalents for all resource inputs and comparing the total of these equivalents on an annual basis to the energy output of the proposed Harry Allen powerplant (Appendix 19).

The energy efficiency of this alternative would be 22.1 percent.

Coal-fired generating capacity (1,400 MW) equal to approximately 14 million barrels of oil per year would be available for use in the service areas of NPC, SCE, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the consumer would benefit from a more stable electricity costs structure.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation of this alternative are presented in table 4-9. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative, and an examination of the relationship between the short-term uses of resources and the maintenance and enhancement of long-term productivity.

TABLE 4-9

ALTERNATIVE 2

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources Irreversible	Irretrievable (40-Year Project Life)	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
Air Quality	Air quality degraded by emission of the following pollutants: Harry Allen Powerplant - 40.8 tons per day of SO ₂ , 8.16 tons per day of particulate matter; and 136.22 tons per day of NO _x .	Yes	No	No	Yes	Emissions would ultimately be dispersed and eventually removed from the atmosphere by wet and dry deposition.
	PSD Class II 3-hour, 24-hour, and annual SO ₂ increments and 24-hour and annual TSP increments exceeded near Harry Allen powerplant. The 3-hour and 24-hour SO ₂ , 24-hour and annual TSP, and annual NO ₂ NAAQS standards exceeded near the Harry Allen powerplant site. Dust plumes from mining activities visible from Yovimpa Point in Bryce Canyon National Park.	Yes	No	No	Yes	See above.
	Brown haze visible from the powerplant under certain meteorological conditions. Cooling tower plumes visible at certain times.	Yes	No	No	Yes	See above.
Water Resources	Loss of up to 7,800 acre-feet per year from pumping of ground water from the Navajo Sandstone aquifer for use as coal slurry. Possible reductions in well and spring yields in adjacent valleys as a result of ground water pumping of the Navajo Sandstone aquifer near Bald Knoll for coal slurry.	Yes	No	No	Project life and beyond	Recharge of the aquifer would require an unknown period of time after project life.
	Loss of natural flow in as many as 20 local springs and possible contamination and sedimentation of surface streams due to surface strip mining in the Alton coal lease area.	Yes	No	No	Project life and beyond	See above; contamination and sedimentation of surface streams would continue for an unknown period of time after project life.
	Consumptive use of an average 27,443 acre-feet of water (effluent) per year from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	No	Project life	Water lost to evaporation in power generating process would eventually be returned via hydrologic cycle; effluent transferred from treatment plant would be made up with increased community growth and related effluent increase.

(continued)

TABLE 4-9 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Retrievable		
Vegetation Species of Concern	Increase in flood depth in Dry Lake playa with operation of flood control dikes around Harry Allen powerplant and facilities.	Yes	No	No	Yes	Flood levels would drop to natural levels with dismantling of powerplant and dikes.
	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
	Construction and operation of coal slurry pipeline and electrical transmission system disturbing up to 10,915 acres of habitat of the desert tortoise (<i>Gopherus agassizii</i>), a species threatened in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Yes	See above.
Cultural Resources	Adverse impact to an estimated 313 archaeological sites with the construction of the various project components.	Yes	Yes	Yes	Yes	Although some information would become instantly available, construction activities could result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impact to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
Recreation and Aesthetics	Impact on natural setting of the Honeymoon Trail (currently nominated for inclusion on the National Register) with the construction of the coal slurry pipeline.	Yes	No	No	Yes	Construction and operation of pipeline and facilities would alter the natural character of the trail until project would be decommissioned.
	Adverse impact to the scenic character of Dry Lake, Nevada when visibility reduced by concentrations of stack emissions from the Harry Allen powerplant; also adverse impact to local aesthetic and recreational resources.	Yes	No	Project life	Yes	Emissions would ultimately be dispersed and removed naturally in the atmosphere.

(continued)

TABLE 4-9 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Retrievable		
	Approximately 1,550 acres of the visual resource as viewed from Yovimpa Point in Bryce Canyon National Park degraded with strip mining activities at the Alton East coal lease area.	Yes	Unknown	Unknown	Yes	Portions of the visual resource could be permanently altered even after reclamation.
	Noise generated during mining activities (including blasting) in the Alton coal lease area would impact recreation and aesthetics values at Bryce Canyon National Park. Blasting could be perceived as being 64 times louder and truck noise 2 to 16 times louder than natural background levels.	Yes	No	Project life	Yes	Noise pollution would cease with the termination of mining activities.
	Decrease in the value of the park experience in Bryce Canyon National Park as perceived by approximately 20 percent of park visitors.	Yes	No	No	Project life and beyond	The value of the park experience would be decreased until after mining activities would be terminated and affected lands reclaimed.
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
Wilderness	Violation of BLM Wilderness Study Areas in southern California with placement of three of four alternative routes of the Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
Land Use	Change from present land uses to project uses on 17,351 acres.	Not applicable	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Kane and Clark Counties for those areas to be occupied by the Alton coal mine and the Harry Allen powerplant respectively. Zoning change in city of Henderson, Nevada for transmission corridor.	Not applicable	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Intrusion of trust lands of Moapa Band-Paiute Indians (if awarded by Congress) with construction and operation of the coal slurry pipeline.	Yes	No	No	Yes	Granting of rights-of-way would be subject to tribal authority. (continued)

TABLE 4-9 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources Irreversible		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Yes	No		
Socio- economics	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in Kane County. Quality of life adversely affected.	Yes	No	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. With- out appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 245 million tons of coal mined at the Alton coal lease area and consumed.	Yes	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

NOTE:

SO₂ = Sulfur Dioxide
 PSD = Prevention of Significant Deterioration
 TSP = Total Suspended Particulates
 NO_x = Nitrogen Oxides
 NAAQS = National Ambient Air Quality Standards

ALTERNATIVE 3: IMPACTS OF MAJOR CONCERN

The implementation of this alternative would involve the following major components which are analyzed according to their significant impacts to the environment: coal mining in the Alton West coal lease area with coal to be trucked to the Warner Valley powerplant site; construction and operation of a 250-MW powerplant at the Warner Valley site in southwestern Utah; construction of the Warner Valley water project consisting of a diversion dam and canal works, an off-stream dam and a 55,000 acre-foot reservoir; construction and operation of a 1000-MW powerplant at the Harry Allen site in Dry Lake, Nevada; coal mining in central Utah or southwestern Wyoming; construction of a transmission system to send electricity from the powerplants to service areas of the city of St. George, NPC, SCE, and PG&E.

Air Quality

This alternative must comply with the applicable State and Federal air quality standards and regulations shown in table 4-1.

Coal Mining and Coal Transportation in the Alton, Southwestern Wyoming, and Central Utah Coal Fields

The emissions from strip mining of coal in southwestern Wyoming and in the Alton West lease area of the Alton coal fields, and underground mining in central Utah would not violate any applicable State or Federal air quality regulations or standards for particulate matter in the immediate area of the mines, the Class I areas of the Bridger Wilderness Area; Zion, Bryce Canyon, and Capitol Reef National Parks; and the potential Class I area of Fossil Butte National Monument (SW, USDI, BLM, 1978; CU, USDI, USGS, 1979; SU, USDI, USGS, 1979). This assumes that BACT would be applied to all mining activity and vehicle traffic associated with mining activity as required by OSM.

There would be no significant particulate matter impacts to air quality from the transportation of coal proposed under this alternative.

Visibility impacts from the strip mining of coal in southwestern Wyoming would be due to the increase of airborne particles. Maximum estimated visibility reductions in the mandatory Class I Bridger Wilderness Area would be less than 0.7 percent from an assumed background visibility of 40 miles. At the potential Class I area of Fossil Butte National Monument, visibility would be reduced by an estimated 8.9 percent (SW, USDI, BLM, 1978). The determination of the significance of these visibility impacts must be made by the Federal land managers responsible for these two areas. At present, this determination has not been made for the Bridger Wilderness Area. Should the State of Wyoming redesignate the Fossil Butte National Monument as a Class I area, NPS would make the significance determination. These estimates are for the operation of the whole southwestern Wyoming coal field. Since the coal mined for the Harry Allen plant would only be a portion of the total coal to be mined, the impact from mining coal for the Harry Allen plant could be less than the above estimates.

Because the increase in particulate matter concentrations at Capitol Reef National Park from mining activities would be expected to be less than the PSD Class I increments, visibility impairment, if any, would be expected to be small (CU, USDI, USGS, 1979).

This alternative has not been analyzed for visibility impacts. However, based on studies for Alternative 1, the strip mining of coal in the Alton West lease area at a rate of 1 million tons per year would not be expected to perceptibly reduce visibility in Bryce Canyon National Park, and mining activities could not be seen from Yovimpa Point or The Promontory. As stated in Alternative 1, pollutant concentrations associated with population increases due to coal mining of Alton West would not be expected to violate air quality standards and regulations (EPA, 1977).

Construction and Operation of the 1,000-MW Harry Allen and 250-MW Warner Valley Powerplants

The air quality impacts from implementation of this alternative have not been studied using dispersion modeling. Instead, the air quality impacts were approximated by a ratio process that related coal qualities, emission rates, and ground level concentrations in the proponents' proposal (Alternative 1) for which dispersion modeling exists. The concentration estimates for Alternative 1 (table 4-4) were multiplied by the ratio of Alternative 3/Alternative 1 emissions to arrive at approximated air quality impacts from this alternative (table 4-10). References cited in this alternative relate to the study or publication identified in Alternative 1, from which the original modeling results were drawn. Only the emissions of the powerplants were considered. The cumulative impacts of powerplant emissions with other existing polluting sources are considered separately.

The following emissions would be expected from the combustion of central Utah coal (12,600 Btu per pound, 0.45 percent sulfur, 6.5 percent ash) or southwestern Wyoming coal (9,827 Btu per pound, 0.54 percent sulfur, 7.38 percent ash) at the 1,000-MW Harry Allen powerplant, and the combustion of Alton coal (8,897 Btu per pound, 0.86 percent sulfur, 7.19 percent ash) at the 250-MW Warner Valley powerplant:

<u>Central Utah Coal</u>	<u>Harry Allen (1,000 MW)</u> tons per day
SO ₂	7.95
Particulate matter	1.22
NO _x	87.20
<u>Southwestern Wyoming Coal</u>	<u>Harry Allen (1,000 MW)</u> (tons per day)
SO ₂	12.06
Particulate matter	1.75
NO _x	72.66
<u>Alton Coal</u>	<u>Warner Valley (250 MW)</u> (tons per day)
SO ₂	5.19
Particulate matter	1.02
NO _x	17.15

These emissions assume 91.85 percent SO₂ control, 99.75 percent TSP control, and 50.5 percent NO_x control.

TABLE 4-10

Estimated Air Quality Impacts Due to Emissions from the Proposed
1,000-MW Harry Allen and 250-MW Warner Valley Powerplants

	Estimated Concentration ($\mu\text{g}/\text{m}^3$)					
	Sulfur Dioxide (SO_2)			Particulate Matter (TSP)		Nitrogen Oxide (NO_x)
	Annual	24-Hour	3-Hour	Annual	24-Hour	Annual ^x
Harry Allen Powerplant Using Central Utah Coal:						
Class II						
EPA Region IX ^a	8.5	18(A)	.....	.....	.....	.....
		67(E)	269(E)	11.0	28.0	47.0
		121(F)	483(F)	23.0	61.0	47.0
ERT ^b	0.7	4.2	49.1	0.1	0.6	7.6
Bechtel ^c	1.0	18.0	60.1	0.5	2.8	6.0
Valley of Fire State Park ^d	0.5	3.3	25.5	0.2	1.0	NC
PSD Standards	20.0	91.0	512.0	19.0	37.0	.....
NAAQS Standards	80.0	365.0	1,300.0	75 (60)	260 (150)	100.0
Class I						
Paiute Primitive Area (Potential Class I Area Only) ^d	<1.0	<1.0	<1.0	<1.3	<2.5	NC
PSD Standards	2.0	5.0	25.0	5.0	10.0	.....
Harry Allen Powerplant Using Southwestern Wyoming Coal:						
Class II						
EPA Region IX ^a	13.0	28(A)	.....	15.0	39.0	40.0
		102(E)	408(E)	34.0	89.0	40.0
		183(F)	732(F)			
ERT ^b	1.0	6.4	74.8	0.2	0.8	6.3
Bechtel ^c	1.0	27.2	90.8	1.0	4.0	5.0
Valley of Fire State Park ^d	0.7	4.9	38.5	0.2	1.4	NC
Class I						
Paiute Primitive Area (Potential Class I Area Only) ^d	<1.0	<1.0	<1.0	<2.0	<4.0	NC
Warner Valley Powerplant Using Alton Coal						
Class II						
EPA Region VIII ^e	NC	60.0	NC	NC	NC	NC
ERT ^f	3.7	57.5	190.0	0.8	5.8	11.9
Stearns-Roger ^c	0.8	34.0	35.6	0.1	3.6	2.7
State of Utah	7.0	26.0	a	0.5	2.0	NC
Class I						
Zion National Park						
EPA ^e	NC	4.5	NC	NC	NC	NC
ERT ^f	NC	NC	1.6	NC	NC	NC
Stearns-Roger ^c	<0.1	2.5	3.9	<0.1	<0.1	0.2
Paiute Primitive Area (Potential Class I Area Only) ^d	<1.0	<1.9	<7.9	<2.5	<5.0	NC

Sources:

^a Modeling summary from EPA Region IX, November 1979, assuming an emission rate of 1.7 tons per hour SO_2 , 0.18 ton per hour TSP, and 190 tons per day NO_x .

^b ERT, Analysis for Harry Allen, 1977.

^c NPC, 1975.

^d Studies for BLM by Radian Corporation, 1980.

^e EPA Region VIII letter October 23, 1979 from Robert L. Duprey, Director Air and Hazardous Materials Division, to John Arlidge, NPC.

^f ERT, Analysis for Warner Valley, 1977.

^g Assumes EPA Region VIII BACT analysis of 99.56 percent control for TSP.

NC = Not Calculated

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

(A) = Stability Class A, highly unstable

(E) = Stability Class E, slightly stable

(F) = Stability Class F, moderately stable

NOTE: Concentration estimates in this table reflect an emission control of 91.85 percent for SO_2 , 99.75 percent for TSP, 50.5 percent control for NO_x for Harry Allen; and 91.85 percent SO_2 , 99.56 percent TSP, and 50.5 percent NO_x control for Warner Valley except as noted in g.

Particulate Matter. Based on the ratio of emission ratios from this alternative to those of Alternative 1, and the relationship of this ratio to modeling done by EPA Region IX (November 1979), ERT (1977), and NPC (1975), burning of Alton coal at a 250-MW Warner Valley powerplant and burning central Utah coal at a 1,000-MW Harry Allen powerplant would not violate any State or Federal air quality standards or regulations for particulate matter (table 4-10). Burning southwestern Wyoming coal would violate the 24-hour Class II increment for particulates. This assumes that the NPC proposed emission control of 99.75 percent for TSP could be obtained. If EPA Region VIII BACT analysis for Warner Valley emission control of 99.56 percent TSP control is all that could be obtained at the Harry Allen powerplant, the resulting estimated concentrations would exceed both the annual and 24-hour Class II PSD incremental limitations using either central Utah or southwestern Wyoming coal (table 4-10). These values were derived using the EPA Valley screening model analysis. A more rigorous analysis using more sophisticated models as outlined in the EPA modeling guidelines and as discussed in Alternative 1 might show lower concentrations.

Based on emissions ratios developed for Alternative 1 and modeling studies done by Radian (1980), it is evident that particulate emissions from the Harry Allen and Warner Valley powerplants would not cause violations of the PSD Class I increments in the Paiute Primitive Area or Class II increments in the Valley of Fire State Park.

Sulfur Dioxide (SO₂). Based on coal comparisons and modeling done previously (Radian, 1980; Warner Valley, ERT, 1977; NPC, 1975), SO₂ emissions from the 250-MW Warner Valley powerplant would not be expected to cause violations of any State of Utah or Federal air quality regulations or standards in the Class II area surrounding the plant site, the Zion National Park Class I area, or the Paiute Primitive Area potential Class I area. Estimated concentrations are presented in table 4-10.

Ambient concentrations from emissions of SO₂ from a 1,000-MW Harry Allen powerplant would cause violations of the Federal 24-hour Class II PSD incremental limitations in the area surrounding the powerplant site if central Utah coal would be burned. Combustion of southwestern Wyoming coal would be expected to cause violations of both the 24-hour and 3-hour PSD Class II increment for SO₂ in areas surrounding the Harry Allen powerplant. These estimates are based on ratios applied to the modeling performed by EPA Region IX using the EPA Valley screening model. A more detailed analysis as discussed in Alternative 1 could show lower concentrations.

Based on emission ratios from Alternative 1 and this alternative, and modeling done by Radian (1980), combustion of central Utah or southwestern Wyoming coal would not be expected to cause violations of PSD Class I increments for SO₂ in the Paiute Primitive Area (if reclassified as Class I) or the 3-hour Class II increments for SO₂ in the Valley of Fire State Park.

Nitrogen Oxides (NO_x). Based on emissions ratios for this alternative and Alternative 1, and modeling done previously for Alternative 1, emissions from the proposed 250-MW Warner Valley and 1,000-MW Harry Allen powerplants would not violate any applicable State or Federal air quality standards or regulations (table 4-10). The major impact from nitrogen oxide emissions would be visibility impairment. This impact is discussed in the Visibility section of this alternative.

Ozone (O_3 , Photochemical Oxidants). As noted in Alternative 1, emissions from the Harry Allen powerplant would not be expected to cause violations of the NAAQS for O_3 .

Plume Opacity. The Harry Allen and Warner Valley powerplants must comply with the NSPS of 20-percent opacity at the stack exit (Federal Register, Volume 44, Number 113). The plume from the powerplants would be barely visible at the stack except during periods when the electrostatic precipitators would not be at full operating efficiency.

Trace Elements. The pathways of distribution of trace elements and the long-term accumulation effects are not well known. Based on applicable studies performed for Alternative 1, the concentrations of trace elements emitted from the Warner Valley powerplant would not be considered hazardous to plants or animals over the life of the project (NPC, 1975). The limited analyses available show that burning central Utah coal at the Harry Allen powerplant should not pose a threat to plants and animals. The impacts from combustion of southwestern Wyoming coal are unknown. Based on impacts estimated for Alton coal (Alternative 1), there would not be a significant impact over the life of the project. The magnitude and estimated impacts of emissions of trace elements are presented in tables 5 and 6 of Appendix 13 respectively.

The USFWS biological opinion of 1978 specified a concern about possible toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed powerplant site. These requirements are reiterated in the Standard Operating Procedures section of Appendix 6.

Radioactive Nuclides. There would be no significant impacts anticipated from the combustion of Alton coal. Since the emission of radioactive nuclides under this alternative would be less than Alternative 1, no adverse impacts would be expected.

Condensed Water Plumes. The cooling tower and stack plumes would be visible from the proposed Harry Allen and Warner Valley powerplants. The length and height of the plumes would be dependent upon the ambient temperature and the number of generating units in operation. It could be assumed, however, that the height and length of these plumes would not be greater than those discussed in Alternative 1 since the powerplant sizes would be 50 percent less. No adverse impacts from the cooling tower plumes would be anticipated over the life of the project.

Secondary Pollutants. The impacts of secondary pollutants are discussed in Alternative 1. Because of the qualitative nature of the discussion, the same conclusion can be drawn that the major impact from secondary pollutant formation would be visibility impairment, which is discussed in the following section.

Visibility. It is the policy of NPS to protect the scenic values of Class I areas from any adverse visual impairment at human levels of perception (letter from William J. Whalen, Director NPS, to David Hawkins, EPA, Assistant Administrator, Air, Noise, Radiation, April 1979).

The visibility impacts that would be related to this alternative have not been analyzed. However, the visibility impacts have been estimated for Alternative 1. Since the emissions rates of particulate matter, SO_2 , and NO_x from the Harry Allen powerplant would be 85 percent, 81 percent, and 36 percent less respectively when burning central Utah coal, and 79 percent, 70 percent, and 47 percent less respectively when burning southwestern Wyoming coal, the visibility impairment in the Valley of Fire State Park and the Paiute Primitive Area due to the emissions of the Harry Allen powerplant in this alternative would be expected to be less than the reduction in visual range identified in Alternative 1.

Based on emissions data for the 500-MW Warner Valley powerplant in Alternative 1 and ratios for the 250-MW powerplant in this alternative, the reduction in visual range from the Paiute Primitive Area would not be expected to be significant and the visibility impacts would be expected to be small. Although the visibility impacts would be less than identified in Alternative 1, the possibility of some visibility impairment at Zion National Park from the Warner Valley powerplant still remains.

A brown haze could be visible as a result of powerplant emissions under certain atmospheric conditions, due to NO_2 discoloration of the atmosphere. The duration and significance of such an impact is unknown due to insufficient data.

Cumulative Impacts. There are no known developments proposed near the Warner Valley powerplant which would use up part of the PSD increments or otherwise cause violations of the NAAQS to occur when combined with concentrations from the Warner Valley powerplant.

The analysis of the Harry Allen powerplant in combination with any other local sources of air pollution (i.e., Reid Gardner powerplant) must demonstrate that the applicable State of Nevada and Federal air quality standards and regulations would be met. This is being studied by EPA Region IX in their PSD permit review.

Increment consumption by the Harry Allen and Warner Valley powerplants could pose restrictions on future development in those areas. Increment is presently allocated by EPA and the States on a first-come, first-served basis.

Population Growth. The pollutant concentrations associated with population growth due to the AWP energy system would not be expected to violate air quality standards and regulations.

Nonattainment Area of Las Vegas. The impacts of the Harry Allen powerplant on ambient concentrations of total suspended particulates and CO in the Las Vegas nonattainment area would be expected to be minor (less than one-half the values identified by EPA as significant; Federal Register, Volume 45, Number 94). Significance values have not been established for O_3 . However, an evaluation of meteorological conditions associated with historically high O_3 episodes, and a comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_x (O_3 precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Water Resources

Major components of this alternative which would affect water resources would be: coal mining in the central Utah or southwestern Wyoming coal fields and the Alton coal lease area; development of the Warner Valley water project; and water allocation for the construction and operation of the Harry Allen powerplant in Dry Lake, Nevada.

Coal Mining in Central Utah or Southwestern Wyoming

Detailed information concerning the effects of coal mining on water resources in central Utah and southwestern Wyoming is contained in CU (USDI, USGS, 1979), and SW (USDI, BLM, 1978) respectively. Essentially, the major impacts on water resources in these areas would be those due to ground water aquifer interruption and replacement, and surface water contamination from wastes or sedimentation.

Water pollution hazards due to mine drainage would be minimal because water in the low sulfur coal deposits would be essentially the same chemical composition as in the surrounding aquifers.

The pumping of ground water in relation to underground mining in central Utah could reduce spring and well yields in the immediate and adjacent areas (CU, USDI, USGS, 1979). Aquifers would gradually recover after the life of the project.

Ground water interruptions and replacement due to surface mining in southwestern Wyoming would not significantly affect water quality or water movement over the long term. Although there would be temporary increases in permeability and recharge of the backfill (compared to the original material), it would gradually be reduced due to natural compaction (SW, USDI, BLM, 1978). Mining operations in or below saturated zones would alter local hydrologic relationships and could reduce spring yields and streamflows and lower water levels in local wells. The number of wells, springs, and streams affected would be small.

Mining effects on surface water quality would depend on the type and concentrations of the wastes, the frequency of flow volumes, and the water quality of the stream affected. Surface runoff in the central Utah coal fields could be diverted into the ground locally due to subsidence and fracturing of the material overlaying the mines and would eventually be discharged elsewhere. However, primary impacts of mining would probably be increased suspended sediments and TDS due to surface disturbance and subsequent runoff. These impacts would be essentially local and would be "... relatively insignificant in terms of sediment movement because the potential source areas are very small" (CU, USDI, USGS, 1979).

Mitigating measures such as retention ponds or contour furrowing would help hold these contaminants on site. These features are described in both coal statements.

Other contaminants could be released from storage and loading areas, sewage treatment plants, and other mine facilities. Wastewater may include fecal bacteria, petroleum products, detergents, and solvents, which if

allowed to discharge directly or indirectly into the stream through settling ponds or runoff, would lower the quality of downstream water. Data is not available to assess the impact that effluent would have on stream water quality in the coal fields if the effluent would be released directly to streams. However, EPA and State regulations allow no decrease in the quality of water at the point of discharge of any effluent to the stream.

Coal Mining in the Alton Coal Lease Area

Impacts of coal mining in the Alton coal lease area are addressed in SU (USDI, USGS, 1979), in the OSM draft SUPED (USDI, 1980), and are further discussed in Alternative 1 of this chapter. Essentially the major impacts on water resources from mining in the Alton West lease area would be those of disturbance or removal of shallow ground water aquifers and associated springs due to surface mining and backfill replacement, possible surface water contamination from mine wastes, and possible increased sedimentation. For further discussion see Alternative 1 (Water Resources), although impacts to water resources under Alternative 3 would be less significant due to the smaller size of the coal mine and the area that would be affected.

Warner Valley Water Project

This analysis is based on flow regimes stipulated in the 1978 USFWS biological opinion designed to protect the endangered woundfin minnow (USDI, USFWS). A simulation of this flow regime for the years 1940 through 1975 is used as the basis of this analysis (Stauffer, Utah Division of Water Resources, January 24, 1980). The simulation consists of two components: (1) an analysis of the reservoir system and proposed water uses, and (2) an analysis of the effects of diversions and subsequent regime on the Virgin River below the proposed diversion site.

Based on the simulation, the average annual reservoir yield would be 24,000 acre-feet. With this average annual yield, the 49,500 acre-foot annual delivery schedule as proposed by the Washington County Water Conservancy District (December 6, 1979; fig. 2-13) would not be realized.

The Warner Valley powerplant (250 MW) would use an average of about 3,000 acre-feet of water per year from the reservoir. However, up to 6,000 acre-feet of water per year could be used, depending on climatic conditions, coal burn rates, and consumer electricity demand. An additional 8,000 acre-feet per year would be used for supplemental irrigation on presently irrigated land in Washington County.

Of the 24,000 acre-foot average annual yield of the reservoir, only 10,000 acre-feet would be available to meet potential uses (table 2-10; fig. 2-13). This analysis assumes that the powerplant would consumptively use 6,000 acre-feet of water annually and that the dead storage volume of 5,000 acre-feet would be stored the first year that the available water supply would exceed the two firm commitments.

Based on simulated inflows to the reservoir, and outflows modified to reflect only proposed power and irrigation requirements, a recreation and fisheries usage could be maintained until other proposed uses would be developed (fig. 2-10). This flow regime would maintain the reservoir at its

55,000 acre-feet storage capacity. In addition, this proposal assumes that reservoir water quality would be adequate for fisheries use and that adequate supporting recreational facilities would be developed. Reservoir drawdown during the summer months would average 3 to 4 feet (Stauffer, January 24, 1980; Bingham Engineering, 1977) and should be adequate for fisheries stocking.

Reservoir Water Quality

Average TDS would range between 500 and 600 mg/l depending on evaporation and the influence of the geologic formations underlying the reservoir, and would be the only chemical parameter exceeding State of Utah recommended drinking water standards. According to the State of Utah Department of Social Services, Division of Health (1975), the water from the reservoir would require full treatment before it could be used as a culinary source.

Turbidity levels in the reservoir would be seasonal, being low during summer months and high during winter and early spring (Alternative 1, same component).

Based on 7 years of sediment data at the Hurricane gaging station and quantitative analysis procedures used by Vaughn Hansen Associates (208 Water Quality Study, 1977), approximately 243,000 tons of sediment would be diverted annually under the proposed diversion schedule. Of this, about 155,000 tons would flow into the Warner Valley reservoir. At this rate, the reservoir's 5,000 acre-foot dead storage capacity would be filled in 50 to 70 years. Continued sedimentation beyond these dates would reduce usable storage capacity.

Failure of the proposed Warner Valley dam would result in a flood at least as damaging as a standard project flood as identified by the Army Corps of Engineers (U.S. Department of Defense, 1973). Failure would require breaching, and a flood of greater magnitude than the 100-year flood on the Virgin River could result. The probability of such a flood is not known.

New springs may occur on the west side of Warner Ridge as a result of the reservoir. Water could move through the Shinarump member of the Chinle Formation and issue from the Moenkopi Formation (Bingham Engineering, 1977). These springs would discharge on adjacent public lands and would ultimately empty into the Virgin River. The likelihood of their occurrence or quantity of flow of these springs cannot be estimated.

Effects on the Virgin River System

Impacts to the Virgin River system below the diversion are analyzed by river segments. Table 4-5 lists pre and post-project median flows, based on a computer simulation of the Utah Division of Water Resources (Stauffer, January 24, 1980).

Hurricane Diversion to St. George-Washington Fields Diversion.

Average annual flows bypassing the proposed Hurricane-Warner Valley water project diversion would be about 69,500 acre-feet, which would reduce the annual flow bypassing the diversion by about 24 percent. Median flows bypassing the diversion would be reduced by approximately one-third during the winter and spring (table 4-5).

Of the 242,600 tons of sediment diverted on the average each year, the desilting works would be expected to return about 48,500 tons of sediment to the river below the diversion, which would be carried downstream by the remaining 61,000 acre-feet of water passing the diversion each year. In addition, flows with the highest concentrations of sediment (greater than 20,000 mg/l), would be allowed to pass the new diversion. Consequently, the net effect of the diversion and desilting works would be to decrease the total load carried by the river by about 5 percent and increase downstream concentrations of suspended sediment perhaps by as much as 60 percent per year below the proposed diversion.

With the CP National Utilities Company continuing the diversion of 40 ft³/s for hydroelectric power generation and the Warner Valley water project diversion, the river would be expected to be dry from the LaVerkin diversion to LaVerkin Springs about 25 to 35 percent of the time, including some winter and spring months of dryer years. By comparison, preproject no-flow conditions below the LaVerkin diversion would probably occur about 10 to 20 percent of an average flow year.

Average water quality would be impaired below LaVerkin Springs because of the decrease in flow available to dilute the saline LaVerkin Spring flow. Annual TDS concentrations would average 2,040 mg/l and would reach 9,600 mg/l 25 to 35 percent of the time. At the powerplant return flow, dilution by 40 ft³/s would reduce the annual average to about 1,500 mg/l, an increase of about 350 mg/l over preproject conditions.

Post-project median flows at the Hurricane gaging station would be expected to range from 75 to 130 ft³/s yearlong, with flows over 100 ft³/s during the winter and spring (table 4-5). Low flows during summer months would not be changed significantly since additional water would not be diverted at the proposed Warner Valley water project diversion under these conditions.

Based on simulated flows from 1940 to 1965, it appears that average salinities near the Hurricane gaging station would increase approximately 100 mg/l annually. Salinity is inversely related to flows; generally the higher the flow the lower the salinity because of the effect of flow on dilution of the water from LaVerkin Springs. The increase in salinity could cause the remaining flows in the river to be less suitable for irrigation water at the St. George-Washington Fields diversion. However, impacts to these users could be negligible or slight during summer months when high quality reservoir releases would supplement water diversions from the river. The net effect may be an improvement of irrigation water for use in the St. George - Washington Fields area. The impact of the increased sediment concentrations on downstream water users would probably be minimal. While the remaining water in the river would be carrying more sediment on the average, concentrations would be well below 10,000 mg/l and would not be prohibitive for diversion for agriculture. In addition, the new diversion would probably not increase the frequency of flows with extremely high concentrations of suspended sediment greater than 20,000 mg/l, which generally cannot be diverted for irrigation.

St. George-Washington Fields Diversion to Bloomington. Following construction of the project, nearly all flows from May through October would

be diverted at the St. George-Washington Fields diversion. Median flows would be reduced by half or more yearlong except during the summers, when nearly all flows would be diverted.

Flows bypassing the diversion would generally be less than 20 ft³/s from May through October. Winter and spring flows would exceed 70 ft³/s about half the time.

Flows would increase downstream from ground water influx and irrigation return flows to where postproject flows would be generally expected to be greater than 40 ft³/s year round at Bloomington.

Salinity concentrations below the St. George-Washington Fields diversion would increase from irrigation return flows. This effect would be greatest during the summer months but specific TDS values are not known. The total flow in the Virgin River below the diversion is partially attributable to ground water accretions, and whether the supplemental irrigation would alter the existing ground water component (quality or quantity) is not known.

Average annual flow would be expected to be reduced by at least 15,000 acre-feet at Bloomington because of consumptive use (table 4-6). Consumptive use was calculated for each of the proposed uses of the reservoir water with the following assumptions:

1. Reservoir seepage and annual losses of 5,200 acre-feet would not be returned to the river (Stauffer, February 5, 1980).
2. Powerplant consumptive use would be 6,000 acre-feet per year.
3. Municipal and industrial losses would be about 40 percent of the reservoir water intended for those purposes (4,000 acre-feet). The remainder would be returned to the river.
4. Since 8,000 acre-feet of water has been identified for supplemental irrigation, no significant increase in agricultural consumptive use would occur. See Alternative 1 for additional discussion.

Bloomington, Utah to Lake Mead, Nevada. The Virgin River loses an average 51 ft³/s to infiltration above the Virgin River Gorge. If the flow at Bloomington would be less than the infiltration capacity, then no water would enter the Gorge and the river would be dry to Littlefield Springs.

Summer flows at Littlefield, Arizona would be augmented by the new reservoir releases and return flow. Median flows could increase by 5 to 40 ft³/s during the summer but could be reduced by 60 to 125 ft³/s from November to May.

If the effluent reach is related to Littlefield Spring as evidence indicates, it appears that the loss of recharge to the aquifer during the winter months would be offset by the newly sustained recharge during the summer months (table 4-5). However, the water recharging the aquifer would be of poorer quality than the preproject water as described previously. It is possible that ultimately the TDS concentrations in the Littlefield Springs flow would be increased in proportion to the increase in TDS experienced at the Hurricane gaging station upstream.

The expected increase in salinity would probably range from 200 to 500 mg/l from November through May following construction of the project. Average salinity could be reduced by as much as 60 mg/l with the increased flow expected during the summer months. These calculations were made assuming that the quality of the water coming from the upper Virgin River would be the same under postproject conditions. However, the salinity of the upper basin water would be increased as described previously due to the reduced flows and increased salinity below LaVerkin Springs, and the increased return flows (irrigation and industrial) below the St. George-Washington Fields diversion. Quantitative effects of the increased salinity on the water quality of the Virgin River below the Virgin River Gorge is not known, but it is assumed that this factor would increase the projected TDS values for winter, spring, and annual flows.

Water users below the Virgin River Gorge should not be significantly affected by the altered flow regime and water quality. Since only good quality snowmelt peak flows are used for leaching and since these flows would continue to pass by the upstream diversions, no change from the present situation would be expected. In addition, when lower quality winter flows are diverted, they are used primarily to sluice sediment out of the canals. Additional water could be available during summer months due to increased irrigation return flow below Washington Fields. Primary crops grown in this region are alfalfa, grains, and some silage (personal communication, Dee Hughes, former President of Mesquite Canal Company, January 23, 1980).

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant along with the necessary diversion dikes and storage and settling ponds would reduce the surface area of Dry Lake playa by 1,850 acres. This would elevate flood levels of a potential 50-year flood by 8.5 feet above the present natural ponding elevation. This could result in increased maintenance problems for the existing transmission lines located along the eastern end of the playa. Flooding of the old highway frontage road and access to the town of Dry Lake should be eliminated by construction of the proposed flood control structures.

No significant impacts to Las Vegas Wash would be expected from the transfer of an average of 16 mgd of effluent from the Clark County AWT plant to the powerplant (Alternative 1, same component).

Wetlands and Floodplains

The major areas of concern are the areas of proposed coal development, the reduction of Virgin River flows on wetlands, and the proposal to locate the Harry Allen powerplant within the 50-year floodplain of Dry Lake (Alternative 1, same component). In addition, proposed rail transport and trucking of coal would require upgrading of existing local facilities which may affect an unknown but probably small amount of wetlands and/or floodplains. Specific information on the 100-year floodplains in these areas is not available (Water Resources, Chapter 3). Approximately 2,610 floodplain acres and at least 29 miles of wetlands along the Virgin River would be affected. UII is presently conducting a baseline hydrologic inventory of the Alton coal lease area. Information on flooding potential, and mapping and a physical description of all lease area drainage basins and appropriate drainage facilities

will be developed. The U.S. Army Corps of Engineers will determine the potential for flooding impacts of the 100-year flood at the Dry Lake site before the final design of the powerplant would be completed.

Vegetation: Species of Concern

Several vegetation species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 7). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to the standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). USFWS recommendations for mitigating impacts to vegetation are included in the Technical Assistance Report in Appendix 15.

Warner Valley Powerplant and Water Project

Two officially endangered species, Pediocactus sileri and Arctomecon humilis, would be impacted with the construction of the Warner Valley powerplant and water project. According to the USFWS biological opinion of July 1980, (Appendix 16) ORV use, development of roads, and the powerplant and water project development would threaten the continued existence of the dwarf bearclaw poppy (Arctomecon humilis).

Central Utah Coal Field

Two locally occurring plants, Townsendia aprica and Astragalus subciner-eus var. basalticus, are proposed endangered and threatened species respectively. Expansion of mining activity could impact the habitat of these species. Townsendia aprica is especially susceptible to impact because of its small numbers and limited habitat (less than 100 individuals in two populations). BLM and USFWS have not conferred on the potential impacts to these species because no mining plan has been submitted. Should this coal source be selected, an intensive on-ground survey would be initiated and BLM and USFWS would confer on the possible impacts to these plant species in accordance with Section 7 of the Endangered Species Act (as amended 1978).

Alton Coal Lease Area

NPS has expressed concern that revegetation of coal-mined lands south of Bryce Canyon National Park could introduce plants not native to the area. Should this occur, it would be possible that these introduced plant species could eventually become established within the park, thereby further altering its natural character.

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 8). Although not expected to be great, the significance, duration, and character of these

impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Their recommendations for mitigating impacts to wildlife are in the Technical Assistance Report (Appendix 15).

Electrical Transmission System

The desert tortoise (Gopherus agassizii), recently officially listed as threatened in Utah by the USFWS, and protected in the States of Arizona, Nevada, and California, could be adversely impacted on 6,206 acres of habitat during the construction of the electrical transmission system (fig. 3-6). Although the electrical transmission system would lie essentially south of the area designated as critical habitat in Utah, collisions with construction vehicles and human capture could result in reductions in local populations.

Warner Valley Water Project

After intensive studies of the woundfin minnow habitat requirements and historical flows of the Virgin River, USFWS stated in their official biological opinion that the Warner Valley project as designed in this alternative would jeopardize the continued existence of the woundfin minnow (Plagopterus argentissimis) (Appendix 15).

According to a report prepared by Drs. James Deacon and Paul Holden (1977), the rare Virgin River roundtail chub (Gila robusta seminuda) would also be adversely affected by the proposed diversions of the Virgin River associated with the operation of the water project. BLM has prepared a biological assessment on the Virgin River roundtail chub (1980), recognizing that the water project as designed in this alternative would adversely impact its habitat. It is the position of USFWS (biological opinion on the woundfin minnow of October 1980, Appendix 15) that the Warner Valley water project as designed would severely impact the rare Virgin River roundtail chub, with impacts being similar to those of the woundfin.

The primary adverse impacts to the woundfin minnow and Virgin River roundtail chub would be attributed to reduced flows in the Virgin River. Reduced flows downstream from the proposed water project diversion would adversely affect these fishes by reducing their populations and habitat downriver to the Virgin River narrows (fig. 4-9). Secondary impacts to the fishes associated with stream flow alterations would be changes in water quality (increased salinity), temperature (changes in critical biological temperatures), the possible introduction of exotic fish species into the reservoir, and outfalls which could lead to competition and possible reduction or extinction of the woundfin minnow (USFWS, USDI, 1978; BLM Biological Assessment, USDI, 1980).

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. It is assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that

75 percent or more will be found to be of National Register caliber under the criteria that they ". . . have yielded, or may be likely to yield, information important in prehistory . . ." (36 CFR, Part 60).

Should an alternative be approved, full and complete inventories would be accomplished according to standard operating procedures (Appendix 6), in accordance with the action plan for compliance with the Advisory Council of Historic Preservation procedures for the protection of historic and cultural resources (Appendix 9), and by the provisions of the "Memorandums of Understanding" developed with the SHPOs involved in the project (Appendix 9).

Central Utah Coal Field, Southwestern Wyoming Coal Field

Approximately 4,540 acres would be affected by mining activities in central Utah, with related impacts to an estimated 43 archaeological sites (CU, USDI, USGS, 1979). An estimated 30 or more of these sites would possibly be of National Register caliber. Principal adverse impacts would be attributed to surface construction of facilities and haul roads. No known historical properties exist in the field.

Destruction or alteration of unknown (buried) sites would occur due to mining activities in the southwestern Wyoming coal field. Although regional estimates of numbers of sites have been made for the field, it is difficult to qualify or quantify archaeological sites without a site-specific mine plan and related survey. It would be expected that 300 sites could be adversely impacted during mining activities (SW, USDI, BLM, 1978), of which a total of possibly 225 or more would be of National Register caliber. Impacts to local historic properties cannot be qualified without a site-specific mine plan.

Alton Coal Lease Area

Based on an average site density of one site per 43 acres, an estimated 43 sites would be adversely impacted during mining activities on 1,830 acres of mining permit area at Alton. Of the total sites, at least 32 would probably be of National Register caliber. Increased population pressure could lead to increased vandalism of some local sites. No significant historical properties are presently known in the Alton coal lease area.

Warner Valley Powerplant

Construction of the powerplant would destroy eight known archaeological sites (Thompson and Thompson, 1976). These sites have not been submitted for determination of eligibility, but it is assumed that five or six would meet National Register criteria.

The Warner Valley portions of the Dominguez-Escalante, Honeymoon, and Temple Trails would be impacted by the construction and operation of the Warner Valley powerplant. The proposed right-of-way for the Warner Valley powerplant would place the facility over a portion of the Dominguez-Escalante Trail (fig. 2-4). The powerplant could conflict with a NPS proposal to add the Warner Valley portion of this trail to the National and Historic Scenic Trails System.

Although the proposed powerplant right-of-way would not directly affect the Honeymoon and Temple Trails, the Warner Valley segments would be indirectly adversely impacted as construction and operation of the plant would detract from the natural setting.

Warner Valley Water Project

No known archaeological sites would be impacted by construction and operation of the water project.

The proposed diversion structure to be built on the Virgin River would, as designed, cause the destruction of the Hurricane Canal/Diversion physical structure. The Hurricane Diversion structure and 6.5 miles of the Hurricane Canal have recently been listed on the National Register of Historic Places. Construction of the proposed diversion and canal structure needed to feed water to the proposed reservoir would destroy the historic diversion structure as well as occupy portions of its canal for channeling waters to the reservoir (Washington County Water Conservancy District, 1975).

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Electrical Transmission System

Construction of the transmission system could adversely impact archaeological sites on 7,388 acres of right-of-way. Segments of the transmission system are considered separately because of their geographical distribution.

Spry to Alton. The nature and extent of the cultural resources along the Spry to Alton corridor are poorly known and it is difficult to qualify or quantify significant impacts. However, an estimated 17 sites would be impacted, including at least 13 probably of National Register caliber.

Warner to St. George. The proposed corridor from the Warner powerplant to St. George has not yet been surveyed. Exact surveying and alignment would determine whether or not any cultural resources would be involved. An estimated three sites would be impacted, two of which would probably be of National Register caliber.

Warner to Pecos. Portions of this corridor have been surveyed for cultural resource values but no significant archaeological sites were located (Turner et al., 1975). Certain segments paralleling the Navajo-McCullough transmission line have yet to be surveyed. An estimated 24 sites would be impacted, including an estimated 18 sites probably of National Register caliber.

Allen to Eldorado. The segment from the Allen powerplant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be adversely impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979).

Interstate 15. An estimated 35 sites would be impacted along this alternative route, 26 of which may be of National Register caliber.

Eldorado-Lugo. An estimated 31 sites would be impacted, 23 of which may be of National Register caliber.

Victorville-McCullough. An estimated 58 sites would be impacted, 44 of which are possibly of National Register caliber.

Highway 66. An estimated 29 sites would be impacted, 22 of which may be of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with the American Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Central Utah Coal Field, Southwestern Wyoming Coal Field

Expanded coal development in the central Utah coal field would create minor impacts to visual resources in the region because those resources have already been impacted by existing coal mining. Underground mining would have only a minor impact on visual resources, depending on the severity and location of subsidence (CU, USDI, USGS, 1979).

Expansion of surface strip mining would further detract from the visual resources of the developed southwestern Wyoming mining region. Approximately 12,670 acres could be adversely affected by mining activities (SW, USDI, BLM, 1978). High walls and spoil piles would temporarily replace existing topography during actual strip mining. Even after reclamation of mined lands, the landscape would not blend entirely with surrounding unmined areas.

Alton West Coal Lease Area

Mining activities in the Alton West coal lease area would not be visible from Yovimpa Point or from The Promontory in Bryce Canyon National Park. VRM Classes III and IV management objectives in the Alton West coal lease area (fig. 3-9) would be exceeded during mining operations and for less than 10 years after reclamation. After successful reclamation, areas of Class III and IV management criteria would be satisfied. Although mining operations would not be directly visible from the park, mine generated dust and noise could impact recreational and aesthetic values of Bryce Canyon National Park. Dust generated from strip mining the Alton West coal lease area could reduce visibility in Bryce Canyon National Park (see Air Quality, Alternative 3, Chapter 4).

Surface mining noise generated in the Alton West lease area would be audible in Bryce Canyon National Park with the most serious impacts occurring at Yovimpa Point. Surface mining noise would generally come from two sources: coal trucks and blasting. Coal trucks in the Alton West lease area would produce maximum noise levels from 4 to 39 decibels at Yovimpa Point. Truck noise would be continuous and would be perceived as a droning at various levels (Foch and Oliver, 1980).

Blasting noise from the Alton West lease area is predicted to be as high as 72 decibels at Yovimpa Point and could occur two to six times a day (Foch and Oliver, 1980).

The proposed route to be used for trucking coal from the Alton West coal lease area to the Warner Valley powerplant would dramatically impact traffic volume. The passing of an average of one coal-laden truck every 10 minutes would adversely affect motoring recreationists along the route, especially near Coral Pink Sand Dunes State Reserve, Hurricane, Kanab, and in Warner Valley for the life of the project (fig. 2-12).

Warner Valley Powerplant and Water Project

The visual resources within the St. George Basin and surrounding landscape would be adversely affected with the presence of the powerplant and related facilities and the area would not meet VRM Class IV objectives for the life of the project (fig. 4-14). Powerplant emissions would degrade aesthetic quality of Zion National Park because the powerplant plume would be especially visible and a yellowish-brown haze could occur during stable air conditions, which occur 30 percent of the time (Air Quality section of this alternative).

No studies have been conducted to determine the impact of air quality degradation from the proposed Warner Valley powerplant on visitors to Zion National Park. Because the park's air quality resource is a major component of visitor enjoyment, any degradation of the resource could affect the value of park visitor experiences and the duration of time visitors spend in the park. This could result in a loss of revenue for local businesses (motels, restaurants, service stations, etc.) which cater to tourists, thus impacting the local economy where tourism-related trade is the primary employer (Socio-economics section in Chapter 3).

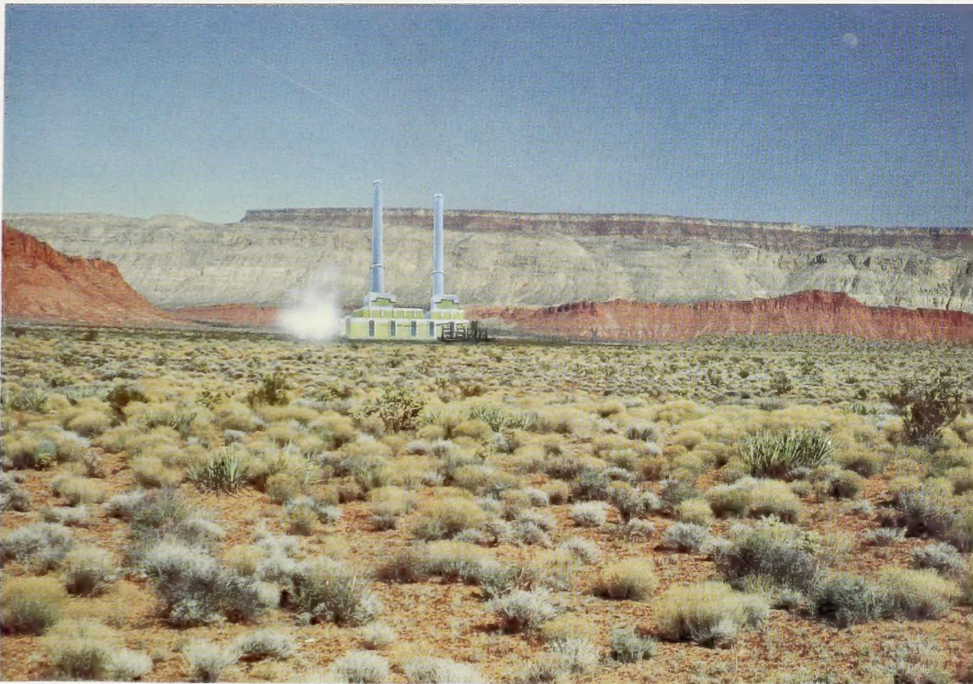
The presence of the proposed Warner Valley reservoir could have a positive impact on the recreational and scenic quality of northern Warner Valley. The reservoir would maintain a 55,000-acre-foot storage capacity, of which 10,000 acre-feet of water would not be utilized for domestic purposes until after the year 2000. Recreational resources such as boating, swimming, and fishing could be developed during this interim period to utilize this surplus capacity until other uses would be required. Reservoir drawdown of 3 to 4 feet during the high recreational use period (summer months) would not be expected to deter recreational use and should be adequate to develop sport fisheries (Water Resources section of this alternative).

The diversion of water from the Virgin River to the Warner Valley reservoir could affect the river's recreational potential for river running. The diversion of up to 160 ft³/s of water during the spring runoff period could



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-14

VISUAL SIMULATION OF 250-MW WARNER VALLEY POWERPLANT

temporarily lower the river's flow rate below 500 ft³/s, which is the minimum flow necessary to support river running. Flows below 500 ft³/s could generally be expected to occur at the beginning and end of the spring runoff period. This would affect the recreational potential by reducing the number of days when the river is capable of supporting river use. Additional information on the Warner Valley water project impacts on the Virgin River is available in the Water Resources and Wildlife sections of this alternative.

Harry Allen Powerplant

The construction of the powerplant would detract from the natural visual character of the site for the life of the project. Presence of the powerplant and facilities would prevent the area from meeting VRM Class III objectives (fig. 4-15). Powerplant emissions and the smokestack plume would impact local visibility and air quality, thereby degrading visual and recreational resources (Air Quality section of this alternative).

Electrical Transmission System

The expected impacts of the Spry to Alton, Warner to St. George, Warner to Pecos, Allen to Eldorado, and the Western Transmission System corridors on recreation and aesthetics would be identical to those discussed in Alternative 1. The construction of access roads would permit increased access to previously inaccessible areas. Visual resources would be impacted with the erection of tower structures and powerlines which would detract from the surrounding scenery.

Wilderness

No BLM Wilderness Study Areas or Intensive Wilderness Inventory Units are within the areas designated for the proposed Harry Allen powerplant, Warner Valley powerplant, Warner Valley water project, central Utah and southwestern Wyoming coal field, and Alton coal lease area. The proposed coal truck transportation route would impact the Upper Kanab Creek (UT-040-255) Intensive Wilderness Unit in Utah (fig. 2-12). The proposed Warner Valley powerplant and three of the Western Transmission System alternative routes could also impact wilderness values. The impacts to wilderness for these components would be the same as described in Alternative 1.

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-9. Present land use would be changed on affected acreage during the 40-year life of the project to the project uses indicated below. After decommissioning, these areas would be available for other uses or would revert to pre-existing land uses.

<u>Component</u>	<u>Acreage Affected</u>	<u>Present Land Use</u>	<u>Project Use</u>
Alton West Coal Lease Area	1,830	Range, Wildlife	Surface mining of 50 acres per year
Central Utah Coal Field (option)	4,540	Range, Wildlife	Underground mining
Southwestern Wyoming Coal Field (option)	12,670	Range, Wildlife	Surface mining
Harry Allen Powerplant	5,000	Recreation, Wildlife	Heavy industrial
Warner Valley Powerplant	3,647	Range, Recreation	Heavy industrial
Warner Valley Water Project	2,993	Range, Recreation	Reservoir, recreation
Electrical Trans- mission System	7,388	Range, Recreation, Wildlife	No change on unfenced rights-of-way; (temporary impact during construction); 359 acres of maintained access roads
Truck Coal Trans- portation Route Alton to Warner Valley	727.4	Range, Wildlife	Transportation of coal

Alton West Coal Lease Area

An analysis of the impacts to land use and land use plans and controls has been previously prepared for the Alton coal lease area (SU, USDI, USGS, 1979; SUPED, 1980). These impacts are further described in Alternative 1 for the same component although less land would be affected under this alternative with the development of only the Alton West lease area for mining.

One exception to the impacts described in Alternative 1 would be the design of the coal transportation system. Trucks hauling coal to the 250-MW powerplant in Warner Valley would require upgrading of roads and highways along the proposed route and the construction of approximately 15 miles of new road. The route would create potential traffic hazards, especially at the intersections with highways U.S. 89 and Arizona 389. Based on 308 truck crossings of these two highways per day (260 days per year) for the life of the project, 80 additional vehicle accidents could be expected to occur (personal communication, Steve Glines, Utah Division of Highway Safety, March 14, 1980).



PHOTOGRAPH BY BUREAU OF LAND MANAGEMENT

EXISTING SITUATION



VISUAL SIMULATION BY BUREAU OF LAND MANAGEMENT

SIMULATED PHOTOGRAPH

FIGURE 4-15

VISUAL SIMULATION OF 1,000-MW HARRY ALLEN POWERPLANT

Warner Valley Powerplant

Significant impacts to land use, land use plans and controls from the construction and operation of the Warner Valley plant would be identical to those described in Alternative 1 for the same component, except that 648 acres less would be needed to construct a smaller powerplant.

A zoning change from the present classification of open space to heavy industrial would be required for the affected area by the Washington County Planning Commission.

Warner Valley Water Project

The impacts to land use of this project would be essentially the same as discussed in Alternative 1, except that up to 18,000 acre-feet of water would be available for irrigation, municipal, and industrial water use (table 2-10). This water could provide 6,000 additional acres of alfalfa, milo, or other crops for Washington County and would amount to 12 percent of the presently irrigated cropland in Washington County (personal communication, Rich Chase, Washington County Agricultural Agent, January 14, 1980).

An average of 3,000 acre-feet would go to the Warner Valley powerplant for electricity production, although up to 6,000 acre-feet per year could be used, depending on consumer electricity demand, coal burn rates, and climatic conditions.

Zoning changes would be required by the Washington County Commission for acreage affected by the implementation of the water project. The multiple use category would be changed to a municipal and industrial based primary use reservoir with an agricultural secondary use. Adjacent lands would be rezoned for recreational use.

Central Utah Coal Field, Southwestern Wyoming Coal Field

Discussion of impacts to land use and land use plans for the central Utah and southwestern Wyoming coal fields is presented in CU (USDI, USGS, 1979) and SW (USDI, BLM, 1978). Present land use would change due to mine expansion on 4,540 acres if central Utah coal would be used, or 12,670 acres if southwestern Wyoming coal would be used. Mining activities would not conflict with State, local, regional, or Federal land use plans, as the areas are already zoned for mine development.

Harry Allen Powerplant

Approximately 5,000 acres of public land would change from the present multiple-use status to the single use/heavy industrial category (BLM Management Framework Plan of the Virgin Valley Planning Unit - Caliente Resource Area, USDI, 1974). A zoning change from rural open to heavy industrial would have to be approved by the Clark County Comprehensive Planning and Environmental Commission.

A right-of-way would have to be obtained for the routing of the AWT pipeline across portions of Nellis Air Force Base in southern Nevada. A right-of-way would be issued by the Air Force if the action would not

interfere with the mission of the base, and the action would be for the good of the public.

Electrical Transmission System

Approximately 7,388 acres of land would be required for the construction and operation of transmission lines. As explained in Alternative 1 for the same component, no conflicts with local, State, or Federal government land use plans or controls would be expected with the construction and operation of the Spry to Alton and Warner to St. George transmission lines. Should either one of two bills introduced in Congress that would provide trust lands for the Moapa Band - Paiute Indians be passed, a conflict with the Warner to Pecos transmission corridor could occur. As in Alternative 1, the applicants would have to apply for a right-of-way for routing this transmission line across Nellis Air Force Base in Nevada. Should the city council of Henderson, Nevada decide to deny use permits for the routing of the Allen to Eldorado transmission line through the incorporated city limits, the applicants would have to find other corridors for the routing of transmission lines.

The four alternative transmission routes of this system would utilize utility corridors identified in the California Desert Conservation Area Final Environmental Statement and Proposed Plan (USDI, BLM, 1980). The I-15 and Victorville-McCullough transmission routes would occur within planning corridors that have been identified for expansion. Portions of the Highway 66 and Eldorado-Lugo alternative routes would, however, follow "contingent" corridors, and would require an ammendment to the Plan before rights-of-way could be approved.

The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or protential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, and through the McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routings.

Socioeconomics

Most major socioeconomic impacts would result from relatively rapid changes in local populations. The effects of such changes would show in the strains they would place on local infrastructures and the capabilities that local governments would have in dealing with and alleviating such strains.

Impacts to Central Utah

Should the central Utah area supply coal to the Harry Allen powerplant under this alternative, the associated mining activities could affect Carbon, Emery, Piute, Sanpete, Sevier and Wayne Counties, but the most pronounced impacts would be anticipated for Carbon and Emery Counties.

Population. Most socioeconomic impacts to the region would be generated by large and relatively rapid changes in population. Under the "high level production scenario" described in CU (USDI, USGS, 1979), the projected level of coal production in the central Utah region would rise from

an estimated 8 million tons per year (mty) in 1979-80, to around 42 mty by 1990. Only about 7 percent of this expansion would be directly attributable to the needs of the Harry Allen powerplant. Given the levels of unspecified markets described in CU (USDI, USGS, 1979), the 42 mty development of coal resources could occur with or without development of the powerplants. In any case, the State of Utah is concerned about the concentration of so much development in just one area and would prefer to see it spread over other coal fields in the State. This level of expansion would be accompanied by a major expansion of regional population from around 60,000 (1977) to 112,000 (1990), an overall 87-percent increase and an average annual increase of nearly 7 percent. However, most of this growth would be expected to occur in the 1980-1985 period, which would increase the actual experienced growth rate to the 13 to 14-percent range and induce major socioeconomic problems in the region.

Employment and Income. With such pronounced increases in population, major impacts to regional employment and income would be expected. Projections (CU, USDI, USGS, 1979) indicate that total employment for the region would increase from 25,030 in 1980 to 47,150 in 1985, an 88-percent increase. The change from 1985 to 1990 would be very small, 47,150 to 47,840 (only 1 percent). Based on 1975 total personal income and total employment figures, these increases would result in an approximated \$520.65 million in 1985 and \$528.27 million in 1990 in total regional personal income (in constant 1975 dollars). Most of the 1980-1985 changes in total employment would result in four sectors: mining (20.8 percent), construction (14.6 percent), trade (19.3 percent), and government (16.8 percent). By 1990, mining would account for 24.2 percent of the region's employment, which represents a 50-percent increase in its share of the labor market. With such growth in a single sector, one which would represent nearly one quarter of the region's economic base, the area would become highly susceptible to fluctuations in the coal market. Major declines such as those that affected the area in the 1950s and 1960s could be a recurring problem in the future, and one of larger proportions.

Services. As indicated in Chapter 3, the general availability of basic services in the region is currently adequate, but little excess capacity exists which could accommodate additional growth. The 13 to 14-percent growth rates projected for the mid-1980s in the region would, however, rapidly overtake any such excess capacity. It would be extremely difficult for the regional infrastructure to accommodate such growth, and major breakdowns in basic services would be likely. The likelihood of "boom-town" problems developing in the area would be very high.

Quality of Life. Population growth rates in excess of 13 percent would be very likely to generate "boom-town" conditions in the central Utah region, especially in Carbon and Emery Counties. Under such conditions, it would be likely that breakdowns would occur in some or all of the basic services of police and fire protection, water supplies, sewage disposal, education, and health care services. Chronic housing shortages already exist and would be expected to become acute as populations expand. With such problems being generated, the quality of life in the region would deteriorate significantly.

Conclusion. If the central Utah region would be chosen as the coal source for the Allen plant, the expansion of workforces attributable to the Allen project alone would blend together with the anticipated major overall regional expansions from other concurrent coal development projects in the region. Lag time between the buildup of such work forces and their demands for services and the flows of tax revenues to the region's municipalities could be expected to precipitate some service failures and consequent declines in quality of life in the region. Overall, employment in the region would be expected to increase with the expansion of mining activities in the region. This would, however, also increase the area's dependence on mining as an economic mainstay, making the region susceptible to major declines if mining activities would decrease in the future.

Impacts to Southwestern Wyoming

If the southwestern Wyoming area would be chosen to supply coal to the Harry Allen powerplant, a demand for an additional 4 mty above the high level scenario production of 35.6 mty would be imposed on the region (SW, USDI, BLM, 1978). The counties affected would be Lincoln, Sweetwater, and Uinta. The most pronounced impacts would be expected in Sweetwater County.

Population. Many major socioeconomic impacts from the expanded development of the region's coal resources would be incurred as a result of relatively rapid population increases. Projected increases between 1980 and 1985 for the three county region as a result of all activities would be some 11,601 individuals (from a 1980 base of 69,293 to 80,894 by 1985). Of these increases, some 8,609 or 74 percent would be attributable to increased mining activities. The 1990 population would be projected at 85,303.

Employment and Income. Employment in the southwestern Wyoming region would increase above the "high level production scenario" (SW, USDI, USGS, 1978) by an estimated 523 jobs to 4,195 jobs for both 1985 and 1990 (for coal mining only). This would push mining's proportion of the regional labor force to over 30 percent, generating an economy which would be extremely susceptible to fluctuations in the mining market. Total personal income for the region would be in excess of \$600.7 million in 1985 and would rise to above \$719 million in 1990. These increases would be 35-percent and 61-percent respectively over the 1980 projected base income level of \$446.6 million.

Services. As increases in regional population would occur, so would demands for services, both public and private. Projections in the regional statement indicate that there would be shortages likely in housing, law enforcement, fire protection, and education on at least a localized basis. No major impacts would be expected in such categories as public utilities or health care because existing capacities should be able to accommodate the influx of people. The lag time between population buildups and increased tax revenues in the region would be a major factor in the above mentioned potential shortages. If such conditions would become severe and/or chronic, the quality of life would be significantly deteriorated.

Conclusion. If the southwestern Wyoming region would be chosen as the coal source for the Allen powerplant, the effects of the resulting work force expansion would be blended with the anticipated overall regional growth.

The overall growth rates between 1980 and 1985 would be around 15 percent, which could be expected to generate some infrastructural problems for municipalities, especially in localized areas. Increased employment in the region would be highly beneficial but would at the same time make the region more vulnerable to major economic declines if mining activities would decrease in the future.

Impacts to Kane County and Its Communities

Project components which would directly affect Kane County and its communities would be: the Alton coal mine; and the coal transportation system via Johnson and Kanab Canyons.

Population. Kane County communities are currently experiencing modest growth in their base populations. With the implementation of this alternative, most communities would receive additional growth, especially during the construction period in the early stages of the project. These impacts are projected in table 3-1 of Appendix 17 through the year 2000. The information below shows the anticipated population changes for the initial 5-year period during which the most significant impacts would be expected to occur:

<u>Community</u>	<u>1980 Baseline</u>	<u>1985 Baseline Pro- jection</u>	<u>Popu- lation with Project (1985)</u>	<u>Increment Due to Project</u>	<u>Percent Annual Compound Growth</u>	
					<u>Without Project</u>	<u>With Project</u>
Kane County	3,929	5,040	5,823	783	5.11	8.19
Alton	75	50	96	46	-5.92	5.06
Glendale	235	312	458	146	5.83	14.28
Kanab	2,095	2,908	3,317	409	6.78	9.63
Orderville	428	512	694	182	3.65	10.15

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

Employment and Income. The implementation of this alternative would significantly expand overall countywide employment. By 1985 an additional 563 jobs would be generated by the project, either directly or indirectly. After the construction phase, this figure would stabilize at around 500. The most conspicuously affected sectors would be mining and transportation, although additional gains would be experienced in trade, services, and government. The significance of the addition of these jobs can be seen in the projected increases in incomes and earnings in the county.

Impacts to countywide incomes would be very substantial. By 1985, project-oriented earnings would total nearly \$10.75 million annually. This, by itself, would amount to nearly 75 percent of what countywide earnings would be for the same time period without the project. The implementation of this alternative would, therefore, provide a very substantial impetus to local economies. These impacts would be:

	Temporary Con- struction	Operating Personnel		Indirect Impacts	Total
		Alton Mine	Truck Fleet		
1985					
Employment	65	210	100	188	563
Income	1,524.8	^a 7,125.2	a	2,034.9	10,684.9
1990					
Employment	0	210	100	188	498
Income	0	^a 9,262.8	a	2,645.4	11,908.2
1995					
Employment	0	210	100	188	498
Income	0	^a 12,041.6	a	3,439.0	15,480.6
2000					
Employment	0	210	100	188	498
Income	0	^a 15,654.1	a	4,470.7	20,124.8

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aIncomes for Operating Personnel are not broken out by category.

Services. The abilities of Kane County communities to provide basic services under this alternative would be only moderately affected. Law enforcement capabilities throughout the county would have to be expanded somewhat, especially in the Glendale-Orderville area. Fire protection services would be adequate to meet population increases, but both health care services and sewage disposal facilities would become marginal and upgrading and expansions would be needed. The major impacts to infrastructural services would occur with the Kane County educational systems which are currently at or above their enrollment capacities and would have to be substantially expanded to accommodate projected growth. The table below summarizes the points in time that the capacities of existing services or those currently under construction would be exceeded by combined baseline and project-related population increases. The information is a composite of more detailed data contained in Appendixes 11 and 17.

Community	Law Enforce- ment Needs	Fire Protec- tion Needs	Water Supply Needs	Sewage Treatment Capacity Needs	School Staff Needs	Health Care Facility Needs
Kane County	...	...	...	...	1980- 1985	...
Alton	a	a	b	b	...	a
Glendale	a	a	b	a	...	a
Kanab	a	1980- 1995	1985- 1990	a	...	a
Orderville	a	a	b	a	...	a

Source: BLM, see Appendixes 11 and 17

^aExisting facilities or staffing already at or near capacity.

^bExisting capacities not projected to be exceeded before the year 2000.

Tax Base. With reduced mine size, no slurry pipeline, and truck hauling, this alternative would have only a moderate effect on the Kane County tax base. The mine complex would have an estimated market value of around \$11.7 million, yielding an assessed value of nearly \$1.14 million. Such an assessment would yield an annual increase in property tax revenues of over \$67,000.

In addition to increased tax base, the mining of coal at the Alton complex would generate approximately \$84,200 annually in Federal coal royalties. These monies would be available primarily to the county and the school district.

Quality of Life. Since this alternative would generally expand economic activity in the county but would not place severe strains on existing infrastructures, it would probably enhance the overall quality of life. One major exception to this would be with the truck haul route, which, as described in the Aesthetics section of this alternative, would be a major detraction to area quality of life. This would be especially true for residents of the Johnson Canyon and Fredonia, Arizona areas, where truck traffic would be concentrated. In these areas and along other portions of the haul route, congested traffic, increased highway accidents, noise, dust, etc., would be major problems. It could be anticipated that the rate of deterioration of road surfaces would be significantly increased, and that normal life patterns of area residents would be disrupted. As such, the quality of life for the residents affected by this component would be markedly reduced.

Conclusion. While this alternative would not provide for the maximum development of the Alton coal fields, it would provide Kane County and its communities with relatively controllable growth. Additional demands would be placed on the existing infrastructure, but extreme hardships and difficulties would not be anticipated. Economic growth in the county would be moderate and the economy would remain relatively diversified, insulating it somewhat from the common "boom and bust" characteristic of mineral and energy development.

Impacts to Washington County and Its Communities

Project components which would directly affect Washington County and its communities would be: the Warner Valley powerplant; and truck traffic from the Alton coal mine to the powerplant. The powerplant would require temporary construction phase work forces of around 500 workers. Operationally, the powerplant would employ as many as 100 workers. The coal transportation system would employ as many as 100 individuals in Washington County.

Population. Implementation of this alternative would significantly affect Washington County population levels. For the period 1980-1985, the county would be expected to receive an annual growth rate increase of around 5 percent. During this same period, the affected communities would be anticipated to receive the following population impacts:

Community	1980 Baseline	1985 Baseline Pro- jection	Popu- lation with Project (1985)	Increment Due to Project	Percent Annual Compound Growth	
					Without Project	With Project
Washington County	24,901	30,578	38,681	8,103	4.19	9.21
Hurricane	2,379	2,565	3,198	633	1.52	6.10
Ivins	594	599	774	175	0.17	5.44
LaVerkin	1,167	1,272	1,571	299	1.74	6.13
Leeds	217	269	332	63	4.39	8.80
St. George	11,111	15,167	20,632	5,465	6.42	13.18
Santa Clara	1,063	1,040	1,393	353	-0.43	5.56
Toquerville	282	266	337	71	-1.11	3.63
Washington	2,218	2,413	3,461	1,048	1.70	9.31

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

Employment and Income. Overall countywide employment would be significantly expanded under this alternative. Increases in employment by 1985 due to this alternative would be around 1,550 new jobs. This estimate includes both construction and operational work forces. Long-term employment would adjust back to around 700 to 800 new jobs. The sectors of the economy most dramatically affected would be construction (temporarily), transportation, trade, and government.

The major impacts of the above increases in employment would be seen in changes to countywide earnings. Increases in employment up through 1985 could generate as much as \$21.4 million per year. During the operation phase, added annual incomes could range from \$8.5 to \$11 million as shown below.

	Temporary Con- struction	Operating Personnel			Indirect Impacts	Total
		Warner Valley Power- plant	Coal Slurry Pipeline	Warner Valley Dam		
1985						
Employment	922	100	10	0	1,212	2,244
Income	7,553.4	2,326.5	a	0	11,520.1	21,400.0 ^a
1990						
Employment	0	100	10	3	458	571
Income	0	2,638.7	a	a	5,814.6	8,453.3
1995						
Employment	0	100	10	3	529	642
Income	0	2,913.4	a	a	6,711.8	9,625.2
2000						
Employment	0	100	10	3	553	666
Income	0	3,216.5	a	a	7,794.1	11,010.6

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aIncomes for Operating Personnel are not broken out by category.

Predictably, the sectors of the economy which would receive the largest portions of these earnings increases would be construction (temporarily) and the transportation/communications/utilities grouping.

Services. Impacts to basic services in Washington County would be essentially the same as described in Alternative 1. Some expansion of such services as law enforcement and fire protection would be needed, especially in the St. George area. The countywide school system would have to be substantially expanded to accommodate increased populations.

Tax Base. The implementation of this alternative would expand Washington County's base assessed valuation by nearly \$32 million, which could amount to an additional \$2.53 million in tax revenues (assuming a mill levy of 78.00 mills). The 1977 assessed valuation in the county was around \$46.5 million (Utah Foundation, 1978), so such an increase in the tax base would be extremely beneficial for the county. In contrast with Kane County, Washington County would not receive any Federal coal royalties.

Quality of Life. Since this alternative would expand the economic activity in the county without generating major stresses on the existing infrastructures, it would probably result in an enhanced quality of life.

Conclusion. As with Kane County, this alternative would provide Washington County with a moderate and relatively manageable rate of growth. Some additional demands would be placed on local infrastructures. Most problems which might occur from such increased loads would be in the form of an aggravation of existing deficiencies rather than an infusion of new ones. The expansion of the county's tax base provided by this alternative would be extremely beneficial and more than sufficient to offset any added infrastructural costs.

Impacts to Clark County and Its Communities

Project components which would directly affect Clark County and its communities would be: the 1,000-MW Harry Allen powerplant; and an electrical transmission system.

The socioeconomic impacts generated in Clark County would be essentially the same or less than those described in Alternative 1. Therefore, no major distinguishable socioeconomic impacts would be anticipated in the Las Vegas Valley metropolitan area.

Tax Base. The assessed valuation of Clark County would be expanded by nearly \$250 million, which could yield an approximate \$15.63 million in increased tax revenues (assuming a levy of 2.2527 per \$100 assessed valuation). Some of this amount would be required to provide services for the added population, but such an expansion of the tax revenues would be expected to add significantly to the tax base above and beyond the amount needed for expanded services.

Impacts to the Western Transmission System Region

Impacts to the Western Transmission System region would be the same as described in Alternative 1.

Coal Resources

A total of approximately 160 million tons of coal would be mined and consumed over the life of the project should the central Utah coal source (120 million tons) be used together with the Alton coal source (40 million tons).

A total of 200 million tons of coal would be mined and consumed over the life of the project should the southwestern Wyoming coal source (160 million tons) be used together with the Alton coal source (40 million tons).

The coal in either option would be unavailable for future procurement and consumption.

Energy Efficiency

This alternative would provide for an average output of 875 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) into another form (electricity). The energy efficiency of this alternative was computed by deriving energy equivalents for all resource inputs and comparing the total of these equivalents on an annual basis to the projected energy output of the Harry Allen and Warner Valley powerplants (Appendix 19).

The energy efficiency of this alternative is calculated at 23.4 percent if central Utah coal would be used, or 23.3 percent if southwestern Wyoming coal would be used.

Coal-fired generating capacity (875 MW) equal to approximately 8.75 million barrels of oil per year would be available for use in the service areas of NPC, SCE, PG&E, and the city of St. George, Utah. If this capacity would be utilized to reduce oil-fired generation, the consumer would benefit from a more stable electricity costs structure.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation of this alternative are presented in table 4-11. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the alternative, and an examination of the relationship between the short-term uses of resources and the maintenance of long-term productivity.

TABLE 4-11
ALTERNATIVE 3

Unavoidable Adverse Impacts, Irreversible/Irrecoverable Commitment of Resources, and the Relationship of Short-term Use of the Environment and the Maintenance and Enhancement of Long-term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)		Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Irreversible	Recoverable	Yes	No	
Air Quality	Air quality degraded by emission of the following pollutants: Warner Valley Powerplant Using Alton Coal - 5.19 tons per day of SO ₂ , 1.02 tons per day of particulate matter, and 17.15 tons per day of NO _x . Harry Allen Powerplant Using Central Utah Coal - 7.95 tons per day of SO ₂ , 1.22 tons per day of particulate matter, and 87.20 tons per day of NO _x . Harry Allen Powerplant Using Southwestern Wyoming Coal - 12.06 tons per day of SO ₂ , 1.75 tons per day of particulate matter, and 72.66 tons per day of NO _x .	Yes	No	No	No	Yes	No	Emissions would ultimately be dispersed and eventually removed naturally from the atmosphere by wet and dry deposition.
	PSD Class II 3-hour and 24-hour SO ₂ and 24-hour and annual TSP increments exceeded with southwest Wyoming coal, or PSD Class II 24-hour SO ₂ increments exceeded with central Utah coal near the Harry Allen powerplant site.	Yes	No	No	No	Yes	No	See above.
	Brown haze visible from both powerplants under certain meteorological conditions. Cooling plumes visible at certain times.	Yes	No	No	No	Yes	No	See above.
	Possible contamination and sedimentation of surface streams and reductions in the yields of up to 20 local shallow ground water wells and springs due to strip mining in the Alton coal lease area.	Yes	No	No	No	Yes	Project life and beyond	Reductions in contamination and sedimentation of surface stream and recharge of shallow ground water aquifers would take an unknown period of time after project life.
Water Resources	Reduction in flows of Virgin River of 29,200 acre-feet per year at the Warner Valley water project diversion.	Yes	No	No	No	Project life and beyond	Project life and beyond	Water project diversions would continue for an unknown number of years after the short-term (more than 100 years), as projected community growth would utilize continually larger quantities of water.
	Warner Valley diversion preclusion of up to 29,200 acre-feet of water per year from downstream use.	Yes	No	No	No	Project life and beyond	Project life and beyond	See above. (continued)

TABLE 4-11 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources Irreversible	Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
	Consumptive use of up to 18,000 acre-feet of water per year for municipal, industrial, and irrigation uses (Warner Valley water project).	Yes	No	Project life and beyond	See above.
	Increased salinity concentration by approximately 100 mg/l in the Virgin River as a result of Warner Valley water project diversion.	Yes	No	Project life and beyond	See above.
	Consumptive use of up to 6,000 acre-feet of water per year at Warner Valley powerplant.	Yes	No	Project life	Water lost to evaporation in power generation process would be eventually returned via hydrologic cycle.
	Consumptive use of an average 17,922 acre-feet of water (effluent) per year from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	Project life	See above; effluent transferred from treatment plant would be made up with increasing community growth and related effluent increase.
	Reduction of water quality in surface streams with increases of total dissolved solids, sediments, and contaminants related to mining in central Utah and southwestern Wyoming.	Yes	No	Project life and beyond	Contamination and sedimentation of surface streams would continue for an unknown period of time after the project life.
Vegetation Species of Concern	Reduction in local spring and well yields due to underground mining in central Utah and related ground water pumping.	Yes	No	Project life and beyond	Recharge of affected aquifer would require an unknown period of time after the project life.
	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Depending on the viability of the species - local populations could recover over time, others might not.
	Loss of population of the endangered bear-claw poppy (<i>Arctomecon humilis</i>) related to the construction and operation of the Warner Valley powerplant and water project.	Yes	Yes	Yes	Loss of this population could lead to the extinction of the species.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Depending on the viability of the species - local populations could recover over time, others might not.
	Reduction of habitat of the endangered roundfin minnow (<i>Plagopterus argentissimus</i>) and the rare Virgin River roundtail chub (<i>Gila robusta seminuda</i>) with the diversion of Virgin River for Warner Valley water project.	Yes	Unknown	Yes	Diversion at proposed rate would reduce habitat and subsequently the numbers of these fishes, jeopardizing their continued existence.

(continued)

TABLE 4-11 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-term Productivity
		Yes	No	Irreversible	Retrievable		
Cultural Resources	Construction and operation of the coal slurry pipeline and electric transmission system disturbing up to 6,206 acres of habitat of the desert tortoise (<i>Gopherus agassizii</i>), a species threatened in Utah and protected in Arizona, Nevada, and California.	Yes		Unknown	Unknown	Yes	See above.
	Adverse impact to an estimated 183 archaeological sites including central Utah coal field, or 440 sites including southwestern Wyoming coal field with the construction of the various project components.	Yes		Yes	Yes	Yes	Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
	Adverse impact to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes		Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
	Destruction of the Hurricane Canal/Diversion physical structure, (currently listed on the National Register) with the construction of the Warner Valley water project diversion structure and canal system.	Yes		Yes	Yes	Project life and beyond	Physical loss of this antiquity would be permanent.
Recreation and Aesthetics	Impact of construction of Warner Valley power-plant on adjacent portions of the Dominguez-Escalante Trail (being studied by NPS for inclusion in the National Historic and Scenic Trail System), the Honeymoon Trail (nominated for inclusion on the National Register) and the historic Temple Trail.	Yes		No	Project life	Yes	Character and use of trails would be impacted along affected portions for the life of the project. After decommissioning, some construction scars would permanently alter natural character of the trails.
	Adverse impact to the scenic character of the St. George Basin, Zion National Park, and Dry Lake, Nevada when visibility would be reduced by concentrations of stack emissions from the Warner Valley and Harry Allen power-plants; also adverse impact to local aesthetic and recreational resources.	Yes		No	Project life	Yes	Emissions would ultimately be dispersed and removed naturally in the atmosphere.
	Further degradation of the visual and recreational resources in central Utah and southwestern Wyoming on affected lands with activities of coal mining.	Yes		Yes	Yes	Yes	Portions of the visual resource would be permanently altered even after reclamation.
	Noise generated during mining activities (including blasting) in the Alton West coal lease area could impact recreation and aesthetics values in Bryce Canyon National Park.	Yes		No	Project life	Yes	Noise pollution would cease with the termination of mining activities.

(continued)

TABLE 4-11 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Irreversible	Retrievable		
Wilderness	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
	Violation of BLM Wilderness Study Areas in southern California with placement of three of four alternative corridors of the Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).
Land Use	Change from present land uses to project uses on 19,096 acres including the central Utah coal field, or 27,226 acres including the southwestern Wyoming coal field.	Not applicable	No	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
	Change in zoning in Kane, Washington, and Clark Counties for those areas to be occupied by the Alton coal mine, Warner Valley powerplant, and Harry Allen powerplant respectively. Zoning change in the city of Henderson, Nevada for transmission corridor.	Not applicable	No	No	No	Yes	Land could be rezoned for other projected uses after project life.
Socio-economics	Change in zoning in Washington County for area to be occupied by Warner Valley water project.	Not applicable	Yes	Yes	Yes	Project life and beyond	Water project would be considered a permanent fixture on the landscape.
	Intrusion on trust lands of Moapa Band-Paiute Indians (if awarded by Congress) with construction and operation of the coal slurry pipeline and transmission system.	Yes	No	No	No	Yes	Granting of rights-of-way would be subject to tribal authority.
	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in the central Utah or the southwestern Wyoming regions, and in Kane County in southern Utah. Quality of life adversely affected.	Yes	No	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 160 million tons of coal mined and consumed if central Utah coal used, or 200 million tons if southwestern Wyoming coal used.	Yes	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.
NOTE: SO ₂ = Sulfur Dioxide		PSD = Prevention of Significant Deterioration		TSP = Total Suspended Particulates		NO _x = Nitrogen Oxides	

ALTERNATIVE 4: IMPACTS OF MAJOR CONCERN

Implementation of this alternative would involve the following major components which are analyzed according to their significant impacts to the environment: coal mining in central Utah or southwestern Wyoming; construction and operation of the 2,000-MW Harry Allen powerplant in Dry Lake, Nevada; and a transmission system to send electrical power from the Harry Allen powerplant to the NPC, SCE, and PG&E service areas.

For analysis purposes it is assumed that the city of St. George would continue to purchase power from Utah Power and Light Company or would purchase layoff power from the participants of the Intermountain Power Project.

Air Quality

This alternative must comply with the applicable State and Federal air quality standards and regulations shown in table 4-1.

Coal Mining and Coal Transportation in Central Utah or Southwestern Wyoming

There would be no significant particulate matter impacts to air quality from the transportation of coal proposed under this alternative.

Visibility impacts from the strip mining of coal in southwestern Wyoming would be due to the increase of airborne particles. Maximum estimated visibility reductions in the mandatory Class I Bridger Wilderness Area would be less than 0.7 percent from an assumed background visibility of 40 miles. At the potential Class I area of Fossil Butte National Monument, visibility would be reduced an estimated 8.9 percent (SW, USDI, BLM, 1978). The relative significance of these visibility impacts must be determined by the Federal land manager (BLM) responsible for these areas. In the case of Fossil Butte National Monument, this determination must be made only if the area is designated Class I. These estimates are for the operation of the whole southwestern Wyoming coal field. Since coal mined for the Harry Allen powerplant would be only a portion of the total coal mined, the impact from mining coal for the Harry Allen powerplant alone would be expected to be equal to or less than the above estimates, depending upon the location of the mining activity.

Because the increase in particulate matter concentrations at Capitol Reef National Park from mining activities in central Utah would be less than the PSD Class I increments visibility impairment, if any, would be small.

Population Growth. The air quality impacts from population growth due to increased strip mining in southwestern Wyoming and underground mining in central Utah have been analyzed in SW (USDI, BLM, 1978) and CU (USDI, USGS, 1979) respectively, and were found to be insignificant. A study completed by EPA (1977) shows that increases in particulate matter, SO_2 , NO_2 , hydrocarbons, CO, and O_3 from mining related population growth could be expected. As discussed in Alternative 1, these increases would not be expected to have significant impacts on air quality over the life of the mining operations.

Construction and Operation of the 2,000-MW Harry Allen Powerplant

The air quality impacts from implementation of this alternative have not been specifically analyzed in a separate dispersion modeling study. Instead, differences in coal quality between Alton coal and the central Utah and southwestern Wyoming coals were compared and the emission rates calculated for this alternative were ratioed with emission calculations from the applicants' proposal (Alternative 1), for which dispersion modeling exists. The concentration estimates for the Harry Allen powerplant for Alternative 1 (table 4-4) were multiplied by the ratio of Alternative 4/ Alternative 1 emissions for the Harry Allen powerplant to arrive at estimated air quality impacts from this alternative (table 4-12) using the EPA modeling results. References cited in this alternative refer to the study or publication from which the original modeling results in Alternative 1 were taken.

The following air quality impacts would be expected from the construction and operation of the proposed 2,000-MW Harry Allen powerplant burning central Utah coal (12,000 Btu per pound, 0.45 percent sulfur, 6.5 percent ash) or southwestern Wyoming coal (9,827 Btu per pound, 0.54 percent sulfur, 7.38 percent ash):

	<u>Central Utah Coal</u> (tons per day)	<u>Southwestern Wyoming Coal</u> (tons per day)
SO ₂	15.90	24.12
Particulate matter	2.44	3.50
NO _x	174.40	145.30

These emissions would comply with NSPS. Since no BACT analysis has yet been made by EPA for the Harry Allen powerplant, the analysis for the Warner Valley powerplant was used.

Particulate Matter. The construction of the Harry Allen powerplant would create particulate matter emissions. These emissions would be minimized through use of BACT as required by the State of Nevada (personal communication, Nevada DEP, March 20, 1980). Similarly, coal storage piles and transfer systems would be sprayed with dust suppressants or enclosed in buildings to minimize particulate matter emissions as agreed to by the project proponents. Therefore, the impacts would not be considered significant over the life of the project.

Combustion of central Utah or southwestern Wyoming coal would comply with emission limitations described under the revised NSPS (Federal Register, Volume 144, Number 113.). When compared to modeling done by EPA using the Valley screening model, the combustion of coal with the qualities stated above at the Harry Allen powerplant would violate the annual and 24-hour PSD Class II increments for particulate matter. These comparisons are presented in table 4-12.

Based upon the ratio of emissions from Alternatives 1 and 4 and modeling done by Radian (1980) for Alternative 1, air quality increments for particulate matter in the potential Class I Paiute Primitive Area and the Class II increments for the Valley of Fire State Park would be met. These results are presented in table 4-12.

TABLE 4-12

Estimated Air Quality Impacts Due to Emissions from the
Proposed 2000-MW Harry Allen Powerplant, Burning Central Utah
or Southwestern Wyoming Coal

		Estimated Concentration ($\mu\text{g}/\text{m}^3$)					
		Sulfur Dioxide (SO_2)			Particulate Matter (TSP)		Nitrogen Oxide (NO_x)
		Annual	24-Hour	3-Hour	Annual	24-Hour	Annual ^x
Central Utah Coal Based On:							
Class II							
EPA Region IX ^a	17.0		36(A)	.....	.....	.....	.....
			134(E)	538(E)	^e 22.0	^e 56.0	94.0
			242(F)	966(F)	^e 46.0	^e 122.0	94.0
ERT ^b	1.3		8.4	98.2	0.2	1.1	15.2
Bechtel ^c	1.0		36.0	121.0	1.0	5.5	12.0
Valley of Fire State Park (Radian)	0.9		6.5	50.9	0.3	2.0	NC
PSD Standards	20.0		91.0	512.0	19.0	37.0	.....
NAAQS Standards	80.0		365.0	1,300.0	75 (60)	260 (150)	100.0
Class I							
Paite Primitive Area (Potential Class I Area Only) ^d	<1.0		<1.0	<1.0	<2.5	<5.0	NC
Southwestern Wyoming Coal Based On:							
Class II							
EPA Region IX ^a	26.0		56(A)	.....	.....	.....	.....
			204(E)	816.0	^e 30.0	^e 78.0	80.0
			366(F)	1,464.0	^e 68.0	^e 178.0	80.0
ERT ^b	2.0		12.7	148.3	0.3	1.6	12.6
Bechtel ^c	1.0		54.4	181.5	1.0	8.0	10.0
Valley of Fire State Park ^d	1.4		9.8	76.9	0.4	2.8	NC
Class I							
Paite Primitive Area (Potential Class I Area Only) ^d	<1.0		<1.0	<1.0	<4.0	<8.0	NC

Sources:

^a Modeling summaries completed by EPA Region IX, November 1979.^b ERT, Analysis for Harry Allen, 1977.^c NPC, 1975.^d Studies for BLM by Radian Corporation, 1980.^e Assumes EPA Region VIII BACT analysis of 99.56 percent control for TSP.

NC = Not Calculated

 $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

(A) = Stability Class A, highly unstable

(E) = Stability Class E, slightly stable

(F) = Stability Class F, moderately stable

NOTE: Concentration estimates in this table reflect an emission control of 91.85 percent SO_2 control, 99.75 percent TSP control, and 50.5 percent NO_x control except as noted in e.

Sulfur Dioxide (SO₂). Based on coal comparisons and modeling done previously by EPA Region IX² (EPA, 1979), SO₂ emissions from the Harry Allen powerplant would violate the 3-hour and 24-hour PSD Class II increments in the area surrounding the plant. The EPA modeling results were based on the EPA Valley screening model. On May 19, 1980, NPC submitted the results of plume tracer studies done by Meteorology Research, Incorporated to EPA Region IX. EPA Region IX met with NPC on October 2, 1980 to review the tracer study and model validation studies of NPC. EPA has approved the SAI CTGM for assessment of the potential impacts from the Harry Allen powerplant subject to certain conditions (personal communication, Thomas A. Cramer, Chief Permits Developments Section Region IX EPA to John Arlidge, NPC, October 10, 1980).

Based on results from a study conducted by Radian (1980) for BLM for Alternative 1 and the ratio of emissions from Alternatives 1 and 4, the PSD Class I increments for SO₂ would not be exceeded in the Paiute Primitive Area potential Class I area. Class II SO₂ increments in the Valley of Fire State Park would not be violated (Radian, 1980). The SO₂ concentration estimates are presented in table 4-12.

Nitrogen Oxides (NO_x). Based on the ratio of emissions from Alternatives 1 and 4 and modeling done previously for Alternative 1, emissions of NO_x from the Harry Allen powerplant would not violate the NAAQS. The visibility impacts from plume discoloration are discussed in the Visibility section of this alternative. The NO_x concentration estimates are presented in table 4-12.

Ozone (O₃, Photochemical Oxidants). As noted in Alternative 1, emissions from the Harry Allen powerplant would not be expected to cause violations of the NAAQS for O₃.

Plume Opacity. Under normal operating conditions the plume from the proposed Harry Allen powerplant would be barely visible at the stack. However, during startup operations before the electrostatic precipitators would be able to reach operating efficiency, or during upset conditions, the plume could be highly visible. These conditions, if they would occur, must be reported to the Nevada DEP within 24 hours and appropriate measures taken to reduce opacity within limitations.

Trace Elements. The coal burned at the generating complex would contain small amounts of trace elements which would be released into the atmosphere during powerplant operation. However, trace element deposition has been difficult to assess. Pathways by which trace elements are distributed through the environment are complex and poorly defined. The long-term accumulation of trace elements from powerplants is not well known. The trace element content of Wasatch Plateau coal (central Utah coal field) is shown in table 7 of Appendix 13.

The USFWS biological opinion of 1978 (USDI, USFWS, "Formal Consultation") specifies a concern about possible toxic buildups in the environment near the proposed Harry Allen powerplant. In this biological opinion, USFWS indicates that BLM should require the applicants to set up a monitoring program to detect trace elements near the proposed powerplant site. These requirements are listed in the Standard Operating Procedures section of

Appendix 6. EPA and State of Nevada requirements for monitoring and emission controls for trace elements are given in the Trace Elements section, Air Quality under Alternative 1 of this chapter.

Radioactive Nuclides. Radioactive materials are present in any coal and certain amounts of radioactive nuclides would be emitted from the stack. Based on combustion of Alton coal, maximum ground level exposure from the proposed Harry Allen powerplant emissions would fall well below the standards for general public exposure set by the Atomic Energy Commission (now U.S. Department of Energy) and, therefore, no significant impact would be anticipated in the short-term (NPC, 1975). Since central Utah coal is lower than Alton coal in radioactive element content, no significant impact would be anticipated. Based on the Alton and central Utah coal qualities, no significant short-term impacts would be expected from Wyoming coal and the impact over the long-term life of the project is not known.

Condensed Water Plumes. Condensation of water vapor emitted from the powerplant stacks and cooling towers would produce a visible plume for a distance downwind from the plant. The stack plume from the Harry Allen powerplant would be visible for more than 400 feet approximately 30 percent of the time. Depending on the number of units in operation, plumes longer than 1 mile would be visible between 1 and 5 percent of the time. Cooling tower plumes longer than 100 feet downwind would occur about 22 percent of the time. Plumes longer than 1,000 feet would occur only about 1 percent of the time. The height of the visible cooling tower plume would exceed 500 feet less than 20 percent of the time and would exceed 1,000 feet less than 1 percent of the time (NPC, 1975).

Because of the distance from major roads, the direction of prevailing winds, and the arid climate, impacts to motorists from icing and fogging of highways by cooling tower plumes from the Harry Allen powerplant should be minimal.

Secondary Pollutants. Gaseous emissions from coal-fired powerplants are carried by atmospheric transport. They can undergo chemical transformation and new pollutants may be formed (Wilson, 1976). SO_2 may be converted to sulfate aerosols (particulates) and NO_x may undergo reactions to form nitrate aerosols (particulates). Sulfate and nitrate aerosols may travel hundreds of miles and cause air quality degradation. Both nitrate and sulfate particulates tend to be fine particles between 0.2 and 2 microns in size. In the arid southwest, aerosols in this size range may be suspended in the air for days before they are removed by natural processes such as wet and dry deposition in soil or on vegetation.

The major impacts from these secondary pollutants would be on atmospheric visibility. This topic is discussed in the following section.

Visibility. Visibility impacts from powerplant plumes are caused by particulates (fly ash), secondary pollutants (sulfates, nitrates), water vapor, and NO_2 . These impacts are generally in the form of (1) reduction in visual range, and (2) visibility of the plume itself (plume blight).

The visibility impacts that would result from this alternative have not been analyzed; however, the visibility impacts due to the Harry Allen

powerplant have been estimated for Alternative 1. The emission rates of particulate matter and SO_2 from the Harry Allen powerplant would be 70 percent and 61 percent less, respectively, burning central Utah coal compared to Alton coal. The emission rates of particulate matter and SO_2 from burning southwestern Wyoming coal would be 57 percent and 41 percent less, respectively. NO_x emissions from central Utah coal would be 20 percent greater than Alton or southwestern Wyoming coal because the NO_x NSPS are less stringent for bituminous (central Utah) coal than sub-bituminous (Alton and southwestern Wyoming) coal.

The decrease in particulate matter and SO_2 emissions from this alternative would cause a decrease in visibility impairment while the increase in NO_x emissions from burning central Utah coal would cause increased visibility impairment.

The net result of the visibility impacts from the decrease in particulate and SO_2 emissions compared with Alternative 1, and the increase in NO_x emissions cannot be determined without more detailed study. It could be expected that impacts to visual range would be less, while the frequency of occurrence and intensity of discoloration from the higher NO_x emissions would be greater with the burning of central Utah coal.

Cumulative Impacts. Emissions from the operation of the Harry Allen powerplant could combine with emissions from the Reid Gardner powerplant located at Moapa, Nevada to cause increased ambient pollutant concentrations. The EPA has notified NPC of its intent to approve the addition of a fourth unit to the Reid Gardner powerplant. Addition of this unit has been estimated to bring the Reid Gardner powerplant within 97 percent of the 24-hour NAAQS for SO_2 and 84 percent of the 24-hour NAAQS for particulate matter. Unit four would also use up 75 percent of the 24-hour Class II PSD increment for SO_2 and 19 percent of the particulate matter increment (letter from EPA to NPC, November 5, 1979). In order to construct the Harry Allen powerplant, NPC must show compliance with the NAAQS and PSD increments alone and in combination with other sources in the area. EPA Region IX is currently assessing these cases in their PSD permit review process.

Population Growth. The increased level of pollution from the population growth associated with construction and operation of the Harry Allen powerplant would not be expected to be significant over the life of the project.

Las Vegas Nonattainment Area. The impacts of the Harry Allen powerplant on ambient concentrations of TSP and CO in the Las Vegas nonattainment area would be expected to be minor (less than the values identified by EPA as significant). Significance values have not been established for O_3 ; however, an evaluation of meteorological conditions associated with historically high O_3 episodes, and comparison of emissions and calculated ambient concentrations of reactive hydrocarbons and NO_2 (O_3 precursors in the photochemical process) with existing emissions of these pollutants in the nonattainment area, indicate that peak O_3 concentrations would not be increased (Radian, 1980).

Water Resources

Components of this alternative which would have significant impacts on water resources would be: coal mining in central Utah or southwestern Wyoming; and the Harry Allen powerplant at Dry Lake, Nevada.

Detailed information concerning the effects of coal mining on water resources in central Utah and southwestern Wyoming is contained in CU (USDI, USGS, 1979) and SW (USDI, BLM, 1978). As discussed in Alternative 3, the major impacts on water resources in these areas would be those due to ground water pumping, ground water aquifer interruption and replacement, and surface water contamination from wastes or sedimentation. Water pollution hazards due to mine drainage would be minimal because water in the low sulfur coal deposits is essentially the same chemical composition as in the surrounding aquifers.

Dry Lake, Nevada and Las Vegas Wash

Construction of the Harry Allen powerplant (along with the necessary diversion dikes, storage ponds, and settling ponds) would reduce the surface area of the Dry Lake playa by 1,850 acres. This would elevate flood levels of a potential 50-year flood by 8.5 feet above the present natural ponding elevation, resulting in increased maintenance problems for the existing transmission lines located along the eastern end of the playa. Flooding of the old highway frontage road (and access to the town of Dry Lake) should be eliminated by construction of the proposed flood control structures.

No significant impacts would be expected in Las Vegas Wash from the transfer of an average 31 mgd of effluent from the Clark County AWT plant to the powerplant. See Alternative 1 for additional discussion.

Wetlands and Floodplains

The major areas of concern as noted earlier under Alternatives 1, 2, and 3 are the lack of data regarding coal development and the proposal to locate the Harry Allen powerplant within an existing floodplain. In addition, the proposed rail transport of coal would require some upgrading of existing facilities in the vicinity of Dry Lake which may affect some wetlands or floodplains. Although the amount of land involved is unknown, it is believed to be quite small. Approximately 1,850 floodplain acres would be affected. The U.S. Army Corps of Engineers will determine the potential for flooding impacts of the 100-year flood at the Dry Lake site before the final design of the powerplant would be completed.

Vegetation: Species of Concern

Several vegetation species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 7). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has conferred with USFWS on these species in accordance with the Fish and Wildlife

Coordination Act (as amended 1958). Their recommendations for mitigating impacts to vegetation are in the Technical Assistance Report in Appendix 15.

Central Utah Coal Field

As described in Alternative 3, two local species of plants located in the central Utah fields, Townsendia aprica and Astragalus subcinereus var. basalticus, are candidates for endangered and threatened status respectively. Expansion of mining activities could impact the habitat of these species, depending on the location of actual surface disturbance. Townsendia aprica is especially susceptible to impact because of small numbers and limited habitat. BLM would confer with USFWS concerning possible impacts on these plant species should this alternative be selected and a mining plan submitted in accordance with Section 7 of the Endangered Species Act (as amended 1978).

Wildlife: Species of Concern

Several wildlife species of concern could be adversely impacted with the construction and operation of the components of this alternative in the States of Utah, Arizona, Nevada, and California (Appendix 8). Although not expected to be great, the significance, duration, and character of these impacts are unknown due to the lack of on-ground information. According to standard operating procedures (Appendix 6), intensive on-ground surveys would be executed on affected lands before construction could begin. BLM has consulted with USFWS on these species in accordance with the Fish and Wildlife Coordination Act (as amended 1958). Their recommendations for mitigation of impacts to wildlife are contained in the Technical Assistance Report (Appendix 15).

Electrical Transmission System

The desert tortoise (Gopherus agassizii) has recently been listed as threatened in Utah, and is protected in the States of Arizona, Nevada, and California. A biological assessment (BLM) and a biological opinion (USFWS, 1980) indicate that the tortoise could be adversely impacted on 8,850 acres of habitat during construction of the electrical transmission system (fig. 3-6). Collisions with construction vehicles and human capture could result in minor reductions of local populations, which would not be of significant impact.

Archaeology, Ethnology, and History: Cultural Resources

Since inventories are not complete, this analysis contains estimates of varying exactness relevant to the amount of resource that would be adversely impacted by various project components. It is assumed that 95 percent or more of these sites will be archaeological (rather than historical), and that 75 percent or more will be found to be of National Register caliber under the criteria that they ". . . have yielded, or may be likely to yield, information important in prehistory . . ." (36 CFR, Part 60).

Should an alternative be approved, full and complete inventories would be accomplished according to standard operating procedures (Appendix 6), in accordance with the action plan for compliance with the Advisory Council of Historic Preservation procedures for the protection of historic and cultural

resources (Appendix 9). Also, provisions would be followed as stipulated in the "Memorandums of Understanding" developed with the SHPOs involved in the project (Appendix 9).

Central Utah Coal Field, Southwestern Wyoming Coal Field

According to CU (USDI, USGS, 1979), six archaeological sites would be impacted on each square mile (640 acres) of ground disturbed. Adverse impacts to 85 archaeological sites would result from mining activities on 9,080 acres where sites are unidentified or buried. Probably 65 or more of these sites would be of National Register caliber. Increased coal development would lead to increased population growth locally and would open previously inaccessible areas. This could result in increased vandalism of archaeological and historical sites. Principal adverse impacts would be attributed to activities of construction of ancillary facilities and haul roads.

Surface strip mining in southwestern Wyoming would adversely impact unknown buried archaeological sites. Such sites would not be discovered until they would be unearthed, altered, or destroyed by mining activities. Approximately 600 sites would be adversely impacted during the life of the project (SW, USDI, BLM, 1978). It is possible that 450 or more of these sites would be found to be of National Register caliber.

Harry Allen Powerplant

No known cultural resources would be adversely impacted with construction or operation of the powerplant (Brooks, 1976; NPC, 1975).

Electrical Transmission System

Transmission system construction would adversely impact cultural resource sites on as much as 8,850 acres of right-of-way. Transmission line segments are considered separately because of their geographical distribution.

Allen to Eldorado. The segment from the Allen powerplant to the Eldorado substation has not yet been inventoried, although some portions of the Navajo-McCullough transmission line (which the proposed line would parallel) have been inventoried with negative results (Turner et al., 1975). An estimated 10 sites would be impacted, seven or eight of which would probably be of National Register caliber.

Western Transmission System. The number of potential archaeological sites that would be impacted due to construction activities along the Western Transmission System from the Eldorado substation in southern Nevada to Lugo, California are estimated by alternative corridors (Barker et al., 1979).

Interstate 15. An estimated 35 sites would be impacted along this alternative route, 26 of which may be of National Register caliber.

Eldorado to Lugo. An estimated 31 sites would be impacted, 23 of which may be of National Register caliber.

Victorville to McCullough. An estimated 58 sites would be impacted, 44 of which are possibly of National Register caliber.

Highway 66. An estimated 29 sites would be impacted, 22 of which are possibly of National Register caliber.

A microwave communication site associated with the transmission system would be constructed on Spirit Mountain in southern Nevada. This mountain is an area of ethnographic importance (Cultural Resources, Chapter 3). In compliance with the American Religious Freedom Act (PL 95-341), consultation was initiated and is ongoing with regional Indian tribal authorities.

Recreation and Aesthetics

Central Utah Coal Field, Southwestern Wyoming Coal Field

As discussed in Alternative 3 for the same component, expanded development of coal resources in the central Utah coal field would have little impact on the visual resources of the region because the area has already been impacted by existing mines. Underground mining would cause only minimal impacts to the visual and recreational resources, depending on the location and extent of subsidence.

Expanded strip mining in the southwestern Wyoming coal fields onto approximately 25,340 acres of presently undeveloped land would further degrade scenic resources in the area.

Harry Allen Powerplant

Impacts to recreation and aesthetics are discussed in Alternative 1 for the same component. Stack emissions from the powerplant would adversely impact local recreational and aesthetic values (Air Quality section of this alternative). Construction of the proposed plant would introduce alien structures to the landscape and the area would not meet VRM Class III objectives (fig. 4-13).

Electrical Transmission System

This alternative would require three separate transmission routes: Allen to Pecos, Allen to Eldorado, and the Western Transmission System. Impacts to visual resources associated with the transmission system would involve the introduction of tower structures and related components as intrusions on the natural landscape. For specific information concerning the Allen to Pecos route see Alternative 2 for the same component. The Allen to Eldorado and the Western Transmission System alternative routes are analyzed in Alternative 1.

Erection of the transmission system would involve the construction of roads to permit access along the proposed corridor on 8,850 acres of right-of-way. These roads would facilitate increased access of ORV recreationists to many previously isolated areas (Alternative 1, same component).

Wilderness

No BLM Wilderness Study Areas or Intensive Wilderness Inventory Units are within the areas designated for the proposed Harry Allen powerplant or the central Utah or southwestern Wyoming coal fields. Three of the western transmission system alternative routes could impact wilderness values. The impacts to wilderness would be the same as described in Alternative 1 for this component.

Land Use, Land Use Plans and Controls

The distribution of land ownership for lands affected under this alternative is described in table 2-13. Present land use would be changed to the project uses indicated below on affected acreage during the 40-year life of the project. After decommissioning, these areas would be available for other uses or would revert to the pre-existing land uses.

<u>Component</u>	<u>Acreage Affected</u>	<u>Present Land Use</u>	<u>Project Use</u>
Central Utah Coal Field (option)	9,080	Range, Wildlife	Underground mining
Southwestern Wyoming Coal Field (option)	25,340	Range, Wildlife	Surface mining
Harry Allen Powerplant	5,887	Recreation, Wildlife	Heavy industrial
Electrical Transmission System	8,850	Range, Recreation, Wildlife	No change on unfenced rights-of-way (temporary impact during construction); 229 acres of maintained access roads

Central Utah Coal Field, Southwestern Wyoming Coal Field

Mining development would change land use on 9,080 acres of currently unmined land in the central Utah coal fields. Zoning in the area already permits mining development. A detailed description of impacts to land use, plans, and controls is provided in CU (USDI, USGS, 1979). Mining activities would not conflict with State, local, or Federal land use plans.

There would be no identifiable adverse impacts to local or State land use plans nor to plans of the Forest Service or BLM concerning mine expansion in southwestern Wyoming onto 25,340 acres of land already zoned for mine development. A more complete description of impacts to land use, and land use plans and controls is available in SW (USDI, BLM, 1978).

Harry Allen Powerplant

A change from multiple use to single use/heavy industrial status would occur on 5,887 acres of land at Dry Lake, Nevada. A zoning change from rural

open to heavy industrial would be required by the Clark County Comprehensive Planning and Environmental Commission.

A right-of-way would have to be obtained for the routing of the AWT pipeline across portions of Nellis Air Force Base in southern Nevada. The base would grant a right-of-way as long as the action would not interfere with the mission of the base and the action would be for the good of the public.

Electrical Transmission System

Approximately 8,850 acres would be needed for the construction of the transmission system. The applicants would have to secure a right-of-way to route the Allen to Pecos line across Nellis Air Force Base in Nevada. Should the city council of Henderson, Nevada decide to deny use permits for the routing of the Allen to Eldorado transmission line through the incorporated city limits, the applicants would have to find other corridors for the routing of transmission lines.

The four alternative transmission routes of the system would utilize utility corridors identified in the California Desert Conservation Area Final Environmental Statement and Proposed Plan (USDI, BLM, 1980). The I-15 and Victorville-McCullough transmission routes would occur within planning corridors that have been identified for expansion. Portions of the Highway 66 and Eldorado-Lugo alternative routes would, however, follow "contingent" corridors, and would require an amendment to the plan before rights-of-ways could be approved.

The crowding of various transmission lines into single corridors would preclude or otherwise impact other existing or potential land uses for the same area. This crowding effect would occur near Rainbow Gardens, in Eldorado Valley, through the McCullough Pass in southern Nevada, and in the Interstate 15, Eldorado-Lugo, or Victorville-McCullough alternative corridors of the Western Transmission System in southern California. Problems may also arise in the limitation or preclusion of future transmission line routings.

Socioeconomics

Most socioeconomic impacts would occur in central Utah or southwestern Wyoming and in the Clark County, Nevada area. They would result from the construction and operation of the powerplant and transmission systems.

Impacts to Central Utah and Southwestern Wyoming

Impacts to these areas would be essentially the same as described in Alternative 3.

Impacts to Kane County and Its Communities

There would be no impacts to Kane County resulting from this alternative.

Impacts to Washington County and Its Communities

There would be no impacts to Washington County resulting from this alternative.

Impacts to Clark County and Its Communities

The socioeconomic impacts attributable to this alternative would be identical to those discussed in Alternative 1.

Impacts to the Western Transmission System Region

Impacts to the Western Transmission System region would be the same as described in Alternative 1.

Coal Resources

A total of approximately 240 million tons of coal would be mined and consumed over the life of the project should the central Utah coal source be utilized. A total of 326 million tons of coal would be mined and consumed over the life of the project should the southwestern Wyoming coal source be utilized. The coal in either option would be unavailable for future procurement and consumption.

Energy Efficiency

This alternative would provide for an average output of 1,400 MW of electrical power (70 percent of capacity). Its energy efficiency is expressed in terms of output as a percent of input and is a factor in determining this alternative's effectiveness in converting one form of energy (resources) to another (electricity). As in Alternative 1, the energy efficiency of this alternative was computed by deriving energy equivalents for all resource inputs and comparing the total of these equivalents on an annual basis to the energy output of the proposed Harry Allen powerplant (Appendix 19).

The energy efficiency of this alternative is calculated at 24.0 percent should central Utah coal be used, or 23.8 percent should southwestern Wyoming coal be used.

Coal-fired generating capacity (1,400 MW) equal to approximately 14 million barrels of oil per year would be available for use in the service areas of NPC, SCE, and PG&E. If this capacity would be utilized to reduce oil-fired generation, the consumer would benefit from a more stable electricity costs structure.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The adverse environmental impacts of major concern which would be sustained unavoidably in the event of implementation of this alternative are presented in table 4-13. Also included are the resources which would be irreversibly or irretrievably committed with the implementation of the

alternative, and an examination of the relationship between the short-term uses of resources and the maintenance and enhancement of long-term productivity.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship of Short-Term Use of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment		Maintenance and Enhancement of Long-Term Productivity
		Yes	No	Irreversible	Irretrievable	(40-Year Project Life)	Yes	
Air Quality	Air quality degraded by emission of the following pollutants: Harry Allen Powerplant - 15.9 tons per day of SO ₂ , 2.44 tons per day of particulate matter, and 174.4 tons per day of NO _x if burning central Utah coal; and 24.12 tons per day of SO ₂ , 3.5 tons per day of particulate matter, and 145.3 tons per day of NO _x if burning southwestern Wyoming coal.	Yes	No	No	No	No	Yes	Emissions would ultimately be dispersed and eventually removed naturally from the atmosphere by wet and dry deposition.
	PSD Class II 3-hour and 24-hour SO ₂ and 24-hour and annual TSP increments exceeded using central Utah coal. PSD Class II 3-hour, 24-hour and annual SO ₂ and 24-hour and annual TSP increments exceeded using southwestern Wyoming coal. NAAQS 3-hour and 24-hour SO ₂ and 24-hour and annual TSP standards exceeded using southwest Wyoming coal.	Yes	No	No	No	No	Yes	See above.
Water Resources	Brown haze visible in the Dry Lake, Nevada area under certain meteorological conditions. Cooling tower plumes visible on occasion.	Yes	No	No	No	No	Yes	See above.
	Contamination and sedimentation of surface streams and reductions in yields of local shallow wells and springs due to strip mining in southwestern Wyoming.	Yes	No	No	Project life and beyond	Yes	Yes	Reductions in the contamination and sedimentation of surface streams and the recharge of shallow ground water aquifers would require an unknown period of time after project life.
	Loss of natural flow in local springs and reduction in yields of an unknown number of wells due to ground water pumping in the central Utah coal fields.	Yes	No	No	Project life and beyond	Yes	Yes	Recharge of aquifers would require an unknown period of time after project life.
	Consumptive use of up to 34,724 acre-feet of water (effluent) from the Clark County AWT plant at the Harry Allen powerplant.	Yes	No	No	Project life	Yes	Yes	Water lost to evaporation would be eventually returned via hydrologic cycle; effluent transferred from treatment plant would be made up with increased community growth and related effluent increase.

(continued)

TABLE 4-13 (continued)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact	Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
			Irreversible	Retrievable		
Vegetation Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 7) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
Wildlife Species of Concern	Adverse impact to an unknown amount of habitat and numbers of various species of concern in the affected States (Appendix 8) with the construction and operation of project components.	Yes	Unknown	Unknown	Yes	Depending on the viability of the species - local populations could recover over time, others might not.
Cultural Resources	Construction and operation of coal slurry pipeline and electrical transmission system disturbing up to 8,850 acres of habitat of the desert tortoise (<i>Gopherus agassizii</i>), a species threatened in Utah and protected in Arizona, Nevada, and California.	Yes	Unknown	Unknown	Yes	See above.
	Adverse impact to an estimated 130 archaeological sites including central Utah coal field, or 645 sites including the southwest term Wyoming coal field with the construction of the various project components.	Yes	Yes	Yes	Yes	Although some information would become instantly available, construction activities would result in the alteration of sites to a point at which the information would not be available for future investigation.
Recreation and Aesthetics	Adverse impact to the ethnologic importance of Spirit Mountain with the placement of a microwave communication station.	Yes	Unknown	Unknown	Yes	Placement of the microwave station could permanently disgrace the sacredness of the mountain.
	The scenic character of Dry Lake, Nevada would be impacted when visibility would be reduced by concentrations of stack emissions from the Harry Allen powerplant; also adverse impact to local aesthetic and recreational resources.	Yes	No	Project life	Yes	Emissions would ultimately be dispersed and removed naturally from the atmosphere.
	Visual resources degraded throughout the affected environment with the actual presence of powerplants and transmission lines.	Yes	No	No	Yes	Decommissioning would remove alien structures from natural environment; some residual construction scars would remain in certain areas.
Wilderness	Violation of BLM Wilderness Study Areas in southern California with placement of three of four alternative corridors of the Western Transmission System, and loss of wilderness character.	Yes	Unknown	Unknown	Project life and beyond	Wilderness characteristics would be lost in affected areas until restored naturally over time (if possible).

(continued)

TABLE 4-13 (concluded)

Environmental Element (Resource)	Impact	Unavoidable Adverse Impact		Commitment of Resources		Short-Term Use of Environment (40-Year Project Life)	Maintenance and Enhancement of Long-Term Productivity
		Impact	Adverse	Irreversible	Irretrievable		
Land Use	Change from present land uses to project uses on 15,196 acres including the central Utah coal field, or 31,456 acres including the southwestern Wyoming coal field.	Not applicable	Not applicable	No	No	Yes	Land could revert to previous uses in most affected areas after project life.
Socio-economics	Change in zoning in Clark County, Nevada for the area to be occupied by the Harry Allen powerplant. Zoning change in city of Henderson, Nevada for transmission corridor.	Not applicable	Not applicable	No	No	Yes	Land could be rezoned for other projected uses after project life.
	Rapid population growth exceeding the abilities of local infrastructures to provide basic services in the central Utah or southwestern Wyoming regions. Quality of life adversely affected.	Yes	Yes	No	No	Yes	Growth trends would stabilize over the course of the project and would probably be reversed at the end of the project. Without appropriate planning, the "bust" portion of the "boom and bust" cycle could be experienced in some areas.
Coal Resources	A total of 240 million tons of coal mined and consumed if central Utah coal used, or 326 million tons if southwestern Wyoming coal used.	Yes	Yes	Yes	Yes	Yes	Coal would be unavailable for future use.

NOTE:

SO_2 = Sulfur Dioxide
 PSD = Prevention of Significant Deterioration
 TSP = Total Suspended Particulates
 NO_x = Nitrogen Oxides
 NAAQS = National Ambient Air Quality Standards

ALTERNATIVE 5: IMPACTS OF MAJOR CONCERN

The description of this alternative is presented in Chapter 2 for the service areas of each of the participating utilities: the city of St. George, NPC, PG&E, and SCE. The impacts of this alternative in each of these service areas are described below. Major impact areas discussed are: energy demand, socioeconomics, and the physical environment.

The year 1990 was chosen as a target date for partial implementation of this alternative and its comparison with energy demand projections in the city of St. George and the NPC service areas (Chapters 2 and 3, Alternative 5). Full implementation would occur by the year 2000. The year 1991 was chosen for the PG&E and SCE service areas because the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) use this year as a target date in their energy demand forecasts and in the analyses of the impacts of implementing conservation and alternative energy sources programs (Biennial Report, 1979; draft Environmental Impact Report, 1980).

The total capacity represented by energy savings and displacement in this alternative would be approximately 5,777 MW in 1991. If this capacity would be utilized to reduce oil-fired generation it would be equivalent to approximately 58 million barrels of oil per year. From this the electricity consumer would benefit from a more stable fuel price structure.

Energy Demand

St. George Service Area in 1990 and 2000

Assuming the implementation of this alternative as described in Chapter 2, there would be an expected reduction in peak demand of about 21.7 percent (10.6 MW) in the St. George service area in 1990, with a corresponding reduction in needed capacity. In the year 2000, as much as 27.2-percent reduction in peak demand would occur, with a resulting reduction in needed capacity of 16.9 MW.

Nevada Power Company Service Area in 1990 and 2000

A reduction of about 10.8 percent (221 MW) in peak demand could be achieved in the NPC service area under this alternative, with a corresponding reduction in the need for capacity. By the year 2000, (with full utilization of this alternative), an 18.8-percent reduction (486 MW) in peak demand would be achieved.

Pacific Gas and Electric Service Area in 1991

There would be a resulting displacement of the need for electrical energy and production of electricity from alternative energy sources totaling approximately 3,553 MW in 1991. The displacement (reduction) of electrical energy demand by solar technology in the year 1990 is applied to the 1991 figure for peak demand, thereby yielding a conservative figure of savings.

Southern California Edison Service Area in 1991

There would be a resulting displacement of the need for electrical energy and production of electricity from alternative energy sources totaling approximately 2,224 MW in 1991 under this alternative. The displacement (reduction) of electrical energy demand by solar technology in the year 1990 is applied to the 1991 figure for peak demand, thereby yielding a conservative figure of savings.

Socioeconomics

The elements of this alternative which would generate socioeconomic impacts would be: possible increases in capital building costs with the installation of alternative energy systems and some conservation/load management components; some shifts and/or expansions in employment as alternative energy support industries come into existence; changing energy use patterns to shift demand peaks downward; and the reduction of overall energy costs to the consumer. Impacts would be anticipated to occur only in those areas where conservation and alternative energy source options would be actively pursued.

City of St. George and Nevada Power Company Service Areas

Although no figures are available on the estimated effects of the development of conservation/alternative energy source programs on total employment numbers in the St. George and NPC service areas, it is reasonable to assume that two types of change in employment could occur. Those persons currently working in energy source related fields (i.e., plumbing, air conditioning, insulation, etc.) could shift to the development of alternative energy sources, integrating this into their existing work loads. New industry could be created by the development of alternative energy sources, generating new employment opportunities in the area (fabrication of alternative resources hardware, etc.). The employment sectors most likely to be affected would be the service and the construction sectors.

Probably the most noticeable impacts of conservation/alternative energy source uses would occur through enforcing conservation/load management programs. These would involve such activities as thermostat setbacks, improving appliance efficiency, changing daily energy use habits to decrease levels of peak demand (e.g., doing laundry, taking showers and baths, cooking, etc. during nonpeak periods of the day), and/or changing to lower wattage lighting (switching from incandescent to fluorescent). Such activities, especially those of rearranging daily habits, could be disruptive when initially put into effect, and depending upon public attitudes, could be viewed as a deterioration of the quality of life enjoyed by residents in the city of St. George and the NPC service areas. In most cases, these activities would involve little or no monetary expenditures (buying more energy efficient appliances would be an exception). Rearrangement of personal schedules and conveniences, possibly conflicting with existing work schedules, could be necessary however, and could be interpreted as changing desired lifestyles.

Pacific Gas and Electric and Southern California Edison Service Areas

Without a project-specific analysis, the socioeconomic impacts of this alternative could not be quantified. A generic discussion follows, however, concerning socioeconomic impacts which could occur.

Development of Alternative Energy Sources. A shift to alternative energy sources could result in a related flux in the job mix. An expansion of employment could be generated, probably in the service and construction sectors. Rates of growth in employment could decrease in the conventional energy source sector (i.e., gas and oil-fired powerplants) as some of these workers would shift over to jobs in the alternative energy source sector.

Development of alternative energy sources could also result in new patterns of population concentration. Facilities and workers would have to be located in some instances at the energy source (i.e., geothermal and wind source areas). This factor could lead to new communities or added growth in established communities that otherwise may not experience such growth.

Displacement of Energy Demand With Solar Technology. Solar technology uses could change the number and mix of jobs in the California economy by 1991. Solar technologies could create more employment for the same amount of energy production than conventional energy technologies (Decade of the Sun, CEC, 1980). Ninety percent of those jobs created would be indirect and induced employment would be brought about with the need for production of solar hardware, water heaters, etc. Employment of solar installers and other related occupations would probably result in an expansion of the service and construction sectors of the economy.

Solar technology, by reducing reliance on conventional energy sources especially in the residential sector, should have a stabilizing or reducing effect on the per capita cost of energy. Although requiring additional initial capital outlays, the reduction in energy consumption would result in a reduction of the actual cost of energy over the long term. High capital outlays required by solar technologies would be offset by savings on monthly energy bills in the long term (Decade of the Sun, CEC, 1980).

Conservation and Load Management. In the short term, a shift to more conservation and less electricity production would require adjustments. Some workers, equipment, industries, and services would be needed for different purposes such as the production and installation of insulation and retrofitting components, utility programs, and streetlight upgrading.

Consumer attitudes could be a barrier to conservation. Many conservation activities should be initiated by individuals, not governments or utility companies. Consumers tend to lack a sense of urgency on energy issues, with few people expressing concern over energy availability and shortages (Comptroller General, 1979). As a result, the active participation of individuals in conservation programs has been slow to develop. In addition, initial conservation costs (i.e., retrofitting insulation, and energy efficient appliances) could discourage consumers.

Individuals could be reluctant to change their lifestyles to accommodate the conservation and load management of energy. Mandatory or voluntary

conservation measures such as retiming household jobs (e.g., washing clothes), and space conditioning and water heating thermostat setbacks could be viewed by most consumers as an infringement on their personal freedom. Many consumers also believe that energy research and development would bring about ways to perpetuate their current lifestyles while requiring little or no sacrifice in current living patterns.

Conservation and load management, by reducing reliance on conventional energy sources especially in the residential sector, should have a stabilizing or a reducing effect on the per capita cost of energy. Although these measures may require additional capital outlays, the reduction in energy consumption should result in the reduction of the actual energy costs to the consumer over the long term.

Energy Costs to Consumers

Several studies have recently been completed in relation to the implementation of energy conservation and alternative energy sources programs as an alternative to the applicants' proposed action. In the analysis of its "Alternatives Development Scenario" (excluding electrical energy displaced with conservation and solar energy), CPUC's AWV project team found that the scenario would be preferable to the proposed action because of its "low costs and healthy financial variables throughout . . . [because] much of the new capacity would be user owned and user financed, . . . and characterized by small unit sizes and short lead times" ("Summary Report," 1980). Furthermore, the implementation of the "Alternatives Development Scenario" would yield more electricity and thus displace more oil than the proposed AWV project, thereby reducing (in comparison) still further the cost of energy to the consumer.

The Environmental Defense Fund, in its An Alternative to the Allen-Warner Valley Energy System: A Technical and Economic Analysis (1980) develops what it feels is a realistic scenario for the development of alternative energy sources for the California utilities participating in the AWV project. This study concludes that the cost to develop the alternative energy sources scenario would be less than the cost of the proposed action, and that the consumers would benefit from smaller development costs reflected in their energy bills.

Physical Environment

The development of alternative energy sources in the participating California utilities' service areas could lead to some adverse impacts to the physical environment. A brief generic discussion of environmental impacts that could occur with the development of some of these alternative resources is provided in this section. Because specific projects and locales are not described in this EIS, environmental impacts cannot be quantified. Site and project-specific environmental assessments would have to be prepared should such projects be planned for development. These impacts would pertain only to development areas in California, as no alternative energy sources (excluding solar) are included in this alternative for the service areas of NPC and the city of St. George.

Air Quality

Geothermal Development. The dry steam processes of the Geysers Known Geothermal Resource Area emit hydrogen sulfide (H_2S) into the atmosphere in sufficient quantities to violate the California Ambient Air Quality Standards for H_2S . Air pollution control districts with jurisdiction in the Geysers area are adopting emission standards which further restrict the H_2S emissions of geothermal powerplants. Emission controls are currently being applied to existing units at the Geysers geothermal powerplant to determine if these emission controls will allow the California Ambient Air Quality Standards for H_2S to be met. The further development of the Geysers Known Geothermal Resource Area will depend on the success of these emission controls.

Biomass (Solid Wastes). The principal emissions from wood-fired powerplants are particulate matter and NO_x . A 50-MW biomass fired plant would not be expected to violate the air quality regulations, but PSD permitting would be dependent on the location and local NAAQS.

Cogeneration. It is required that the combustion of fossil fuels in cogeneration systems meet with Federal and State of California air quality regulations. The present limits or emissions in most California Air Pollution Control Districts would allow a 4 to 6-MW cogeneration system to be constructed without New Source Review requirements for emissions tradeoffs and BACT applications. Thus, most cogeneration projects would not be subject to these limitations. Since the emissions limits in the south coast air basin are the most stringent in California, cogeneration systems would have to be approximately 40 percent smaller than in other parts of the State to avoid New Source Review requirements.

Geology and Seismicity

Geothermal Development. There could be seismic hazards during the production stage of the geothermal development due to the risk of triggering earthquakes by changing the pore pressure in an active fault zone with the injection or withdrawal of large volumes of fluid. The potential consequence of triggering a moderate earthquake during geothermal production could involve damage from intense shaking or landslides to nearby structures, including the powerplant, steam pipes, etc., and rupture of producing wells resulting in a blowout.

There has been earthquake activity in the Geysers Known Geothermal Resource Area in the past. It has been estimated that the Geysers area is likely to be shaken by small to moderate earthquakes over the lifetime of the Geysers powerplant. In addition, the northern coast ranges, in which the Geysers Known Geothermal Resource Area is located, are known for landslides and unstable slope conditions. The increase in geothermal generating capacity in the area increases the risk to electrical supply from geologic/seismic hazards. The careful siting and design of future geothermal generating units would significantly reduce this risk.

Hydroelectric Development. State of California seismicity regulations require that not only must new hydroelectric facilities be satisfactory from a power generation viewpoint, but they must not pose undue seismic risk.

Careful siting of hydroelectric facilities would minimize the seismic risk involved.

Water Resources

Geothermal Development. The threat of drilling mud and associated chemicals escaping from the sump ponds into nearby streams would present a potential stream water quality problem. Many of the ponds would be constructed on 40 to 60-percent slopes and within 0.25 mile of the bottom of the canyons.

The impact on surface streams would be mainly in the form of increased sediment yield stemming from clearing and grading operations. As more roads and wells would be developed, new areas would be affected. Increased development would divert more water from local streams during the drilling phase. This increased diversion of water could cause significant impacts to fish if the diversion period would occur in the late summer.

Hydroelectric Development. The damming of water courses and impounding of water could lead to adverse environmental and economic impacts. The damming of currently running water courses could impact the habitat of local fishes. The impounding of these waters could seasonally or permanently affect downstream water rights and water users, necessitating their finding other sources of water supplies.

Pumped Hydro Storage. The catchment and impoundment of waters would preclude other users from the water resource, requiring them to seek other sources for their water needs. The impoundment of waters could adversely affect current running water fisheries in affected streams.

Vegetation and Wildlife: General

Biomass. The harvesting of solid wastes (such as wood) for power-plant fuel could cause excessive soil disturbance and destruction of wildlife habitat. Accelerated erosion could result from soil disturbance. The loss of wildlife habitat would result in reductions in local animal populations.

Hydroelectric Development. Vegetation and related wildlife habitat would be lost as impounded waters would inundate them. Fisheries habitat in running water streams would be lost with the impoundment of waters.

Geothermal Development. The construction and operation of geothermal developments in the Geysers area would disturb or destroy fish and wildlife habitat. Water would be diverted from the local streams and used in drilling mud while drilling the upper part of the well. If this water would be diverted in the late summer, adverse impacts to fish and other aquatic life could be significant.

Land Use, Land Use Plans and Controls

Hydroelectric Development. The construction of dams and the impoundment of waters would necessitate large amounts of land, which would have to be leased or purchased from private, State, or Federal land owners. Implementation of such projects could require changes in existing zoning and land use controls in affected areas.

Geothermal Development. As with hydroelectric development, geothermal projects would require construction over large expanses of land. Developments would require land purchases or easements, and could require changes in existing land use controls.

Solar and Wind Development. Land would be needed for solar and wind electrical generating stations. Land needed by central station solar units is estimated at 1 to 2 square miles per 100-MW capacity. Land needed for wind generators is estimated at 0.4 to 0.8 square miles per 100-MW (Comptroller General, 1979).

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The implementation of this alternative would utilize essentially renewable resources as its energy source and would involve some physical environmental impacts that could be considered adverse (see preceding discussion). Few irreversible or irretrievable commitments of resources would occur. This alternative would involve minimal and diversified use of the environment in the short-term. Therefore, the long-term productivity of the environment could be enhanced as resources in their natural state would be maintained for future availability.

ALTERNATIVE 6: IMPACTS OF MAJOR CONCERN

No adverse impacts related to the implementation of any one or parts of Alternatives 1 through 5, whether short term or residual, would occur to: climate, air quality and visibility, topography, geology, paleontology, mineral development, soils, water resources (including wetlands and floodplains), vegetation, wildlife, cultural resources, recreation, aesthetics, land use and land use plans and controls, and socioeconomic conditions. Current land uses would continue or the land would be available for unspecified future uses. Coal resources which would have been developed for the proposed project would be available for other uses or projects in the future (i.e., other power projects, chemicals, gasification, etc.). Water resources which would have been utilized or impacted by activities of the proposed and alternative actions would remain available in their present condition for other uses and downstream users (i.e., agriculture, fish habitat, or municipal water supply). Socioeconomic trends would continue as projected (Affected Environment, Chapter 3) without the implementation of the applicants' project.

The alternative of "No Action" to the proposed action would, however, necessitate the development by project applicants of other methodologies to meet the short-term demand for energy in their respective service areas. The utilities would have to investigate the possibility of developing other powerplants or alternative energy sources, which they have concluded through their analysis, are needed to meet that demand.

For analysis purposes, it is assumed that selection of this "No Action" alternative would preclude the implementation of any one or parts of Alternatives 1 through 5. Possible recourses (scenarios) of the applicants are discussed in Chapter 2 under this alternative. The impacts of implementing these recourses are analyzed in the following sections. This impact analysis should serve as an example and is only applied to one of several recourses which could be chosen by the AWV participants.

Washington County Water Conservancy District

The objectives of the Warner Valley water project as proposed by the applicant (to provide water for a municipal water supply, industrial development, and/or agricultural development) would have to be realized through other methodologies or projects. Should an application for a right-of-way to permit construction of a modified Warner Valley water project be resubmitted at a later date, the application would be subject to an environmental evaluation to determine possible impacts to threatened or endangered species, cultural values, riparian habitat, land use, and the hydrological regime of the Virgin River below the point of the proposed diversion. Based upon the results of this evaluation, a supplementary EIS or an environmental assessment would be prepared. Delay of construction of such a project would probably result in an escalation of construction costs, but should pose no adverse domestic water supply problems to the participating communities since construction of a revised water project could be completed before existing water supply capacities would be exceeded.

City of St. George

BLM projections indicate that the city of St. George would exceed its present power supply capacity by 1985. However, the city could obtain a temporary power supply from Utah Power and Light Company. The purchase of additional capacity from Utah Power and Light would probably result in increases in power bills for the city's electricity customers.

Purchase of capacity would solve, at least temporarily, the city's power supply needs, but would still leave unresolved its power transmission line capacity and reliability problems. Without either upgrading existing powerlines or constructing a new transmission line, the city would be unable to receive additional power that could be acquired from Utah Power and Light. According to a CP National Utilities Company spokesman (personal communication, Wallace K. Smith, Electrical Engineer, September 25, 1980), the city's major electrical feeder line (138 kV) reached capacity several times last winter, with the city of St. George's peak demand at 32 MW. This situation could cause power load reductions (brownouts) in the city during its peak use period (winter season), resulting in inconvenience to the city utility's customers.

St. George's ability to attract industry and provide for community base expansion could be restricted if there would be a lack of adequate electrical service. This situation would continue until such time as additional capacity could be developed. CP National, the present owner of the St. George feeder transmission lines, indicates that they plan to upgrade their Cedar City to LaVerkin 69-kV powerline to 138 kV capacity. The upgrading process is scheduled to take about 5 years. Upgrading of the 69-kV powerline and the interconnection to the St. George system would not be expected to pose any major environmental problems.

Other energy resources could be made available to the city of St. George (additional capacity from Western Area Power Administration, layoff power from participants of the Intermountain Power Project, or layoff purchases or ownership shares of the Palo Verde Nuclear Generating Facility), but only with the proper transmission line interconnections.

The city of St. George could not build new oil or gas generators of significant size to meet their energy needs because of the restrictions of the Powerplant and Industrial Fuel Use Act of 1978.

Nevada Power Company

Should NPC be successful in acquiring electrical energy capacity through purchase agreements, except for a probable slight increase in the electricity customers' power bills necessitated by the higher cost of purchased power, few significant impacts would be expected to occur to the environment or the electricity consumer. If such purchases would include ownership shares in the Palo Verde Nuclear facility, this would satisfy both the short-term and mid-term energy capacity needs of NPC. If, however, NPC would not be successful in acquiring capacity through purchase agreement, then the following scenario could occur. The resource plans of NPC currently project a peak demand of 2,096 MW for the year 1990. Without the AWV energy system, a total capacity (including peak and intermediate units) of 2,225 MW is projected.

This demand/supply ratio would only provide for about a 6-percent reserve margin (the typical industry standard is between 15 and 20 percent). Such a small reserve would mean that NPC's ability to meet the peak demands of their electricity customers would be compromised. Should any generating unit or units totaling 130 MW need repairs or fail during a peak use period, then electrical service to their customers would have to be reduced in accordance with plans filed with the Nevada Public Service Commission.

Regardless if either of the two possibilities discussed above would become a reality, the utility would operate its peaking and intermediate generating units at a rate much higher than normal. Since most of these units use oil or natural gas as fuel, the consumption of these limited resources would be substantially increased, although an exact amount cannot be projected.

NPC's concurrent actions to solve their mid-term power needs through participation in the California Coal project could yield a substantial base load energy supply by 1991. This would alleviate the short-term problem noted earlier, provided that this project would be constructed on schedule.

According to information contained in the "Summary Report" prepared by CPUC (1980), development of the California Coal project could create several significant environmental impacts. SCE has proposed five potential sites for this project: Ormond Beach, Ivanpah, Boron, Cadiz, and Rice. The Ormond Beach site is on the coast in Ventura County. Because of potential impacts to air quality, wetlands, and threatened and endangered species, CEC staff has recommended rejection of the Ormond Beach site. The CEC staff has also recommended rejection of the Ivanpah site because of an uncertain water supply. The remaining sites are all in the Mojave Desert: Boron in the northwestern portion; and Cadiz and Rice in the eastern Mojave. The major potential environmental impacts from the California Coal project at the Mojave Desert generating sites would be those on air quality and water supply, and on aesthetic, cultural, and biological aspects of the desert. Each generating site would require transmission lines, with impacts similar to those of the AWV project, particularly for the two eastern sites. The lines from the Boron site would be shorter and would cross slightly different environments.

All of the proposed Mojave Desert sites would require wet cooling towers. Water for the Boron site would come from the California aquaduct, and water for the Rice and Cadiz sites would come from the Colorado River aquaduct. Water from these sources is currently being utilized for agricultural, municipal, and industrial purposes, indicating a potential for conflict of use.

For each of the Mojave sites there would be possible site-specific impacts on biological or other resources of the desert. These are discussed in depth in documents filed with CEC.

Southern California Edison Company

According to information developed by the CPUC staff ("Summary Report," 1980), SCE would have a reserve margin of 26.1 percent by the year 1990. This reserve margin does not include the proposed AWV project. With this size reserve, it would be probable that the electricity customers served by

SCE would not experience any significant change in the quality of service SCE presently provides.

The major effect of not having the AWV project would be SCE's continued use of existing oil-fired generating units to meet customer demands. Continued reliance on this limited fuel source would make utility and consumer costs susceptible to any rapid rise in the cost of oil. A potential annual savings of as much as 7 million barrels of oil per year with implementation of the AWV energy system would not be realized under this alternative.

Should SCE implement the California Coal project, some major environmental impacts could occur. These impacts were noted previously under the analysis for NPC in this alternative.

Pacific Gas & Electric Company

According to information developed by the CPUC staff ("Summary Report," 1980), PG&E would have a reserve margin of between 20.7 and 22.7 percent by 1990. This reserve margin does not include any power from the AWV energy system. This substantial reserve should insure that the electricity customers of PG&E would not suffer any significant reduction in the quality of service they presently receive.

As with SCE, the major effect of not constructing the AWV energy system would be the continued reliance on existing oil-fired generating units. The utility and its customers would be susceptible to any rapid increase in the costs of oil. A potential savings of as much as 7 million barrels of oil per year with implementation of the AWV energy system would be foregone in PG&E's service area (in addition to that already noted for SCE).

Should PG&E implement the Montezuma 1 and 2 project, major environmental impacts could occur to air quality and water resources. The project would include air pollution controls that are designed to meet all applicable air quality standards, taking into account the appropriate offsets. However, concern remains that public health and agricultural productivity could be affected, especially by "noncriteria" (unregulated) pollutants.

The use of cooling water for Montezuma 1 and 2 would have effects that would vary according to the as yet unchosen water source. The cooling water may be drawn from either one of two fresh water supplies otherwise intended for agricultural, municipal, and industrial use: from the Sacramento River at its entrance to Suisun Bay, or from the effluent of the Sacramento Regional Wastewater Treatment Plant.

The use of high quality fresh water for powerplant cooling would have a direct impact on the State's water resources and thus on water demand. Such use is discouraged by the Water Resources Control Board policy on powerplant cooling.

Effluent from the Sacramento Regional Treatment Plant is now discharged into the Sacramento River. Any arrangement to use the treatment plant effluent would probably be ecologically beneficial by removing toxicity and allowing time for increased toxicity degradation.

Once through the cooling process, the water would be discharged into Suisun Bay and Marsh. This would result in increased water temperatures, which are already high in later summer. Suisun Bay and Marsh are critical for several fisheries, especially that for striped bass (California State Water Resources Control Board, 1978). Disruption of eggs, larvae, and food would impact these fisheries.

Any rise in Suisun Bay and Marsh temperatures would increase evaporative losses, which in turn would increase the salinity of the Marsh and Delta. Such increases of salinity are matters of great environmental concern and controversy.

Unavoidable Adverse Impacts, Irreversible/Irretrievable Commitment of Resources, and the Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Only two significant unavoidable adverse impacts can be specifically identified that would result from the implementation of the "no action" alternative: (1) the continued (perhaps short-term) reliance of PG&E and SCE on oil-fired electrical generating powerplants, and (2) the continued dependence by the city of St. George on an inadequate power transmission system. Neither of these two impacts is irreversible but the consumption of oil would be irretrievable. Continued use of scarce oil resources for the generation of electricity is probably not in the best interest of maximizing long-term productivity because these resources may have a higher priority use (e.g., petrochemicals, medicines, textiles, etc.).

Subsequent actions by the project participants could result in a wide variety of possible impacts, such as those noted for the example in the preceding section. However, in the absence of specific proposals, further analyses would be too speculative.

LIST OF PREPARERS

Name and Assignment	Education	Professional Experience
<u>EIS Team Members</u>		
Dave Everett, Team Leader	BS Biology	10 years
Paul Dulin, Assistant Team Leader	MA Environmental Geography	4 years
Terry Lewis, Writer/Editor	MA English	6 years
Glen Yankus, Recreation and Aesthetics, Graphics	MA Parks, Recreation	2 years
Jay Carlson, Socioeconomics	MS Resource Economics	4 years
Bill Wagner, Air Quality	PHD Radiation Biology	14 years
Mark Green, Air Quality	MS Meteorology	3 years
Bill Wiley, Hydrology	BS Geography, Hydrology	2 years
Don Hook, Energy Efficiency	BS Civil Engineering	4 years
Gardiner Dalley, Cultural Values	MA Anthropology/ Paleoecology	2 years
John Anderson, Botany	BA Biology BS Range Management	3 years
Paul Ernst, Quality Control	BS Natural Resources Management	4 years
Ron Tucker, Wildlife	MS Wildlife	2 years
Kent Utley, Engineering	BS Civil Engineering	12 years
Connie Murdock, Clerk/typist	Technical Instruction	9 years
Diana Willson, Clerk/typist	Technical Instruction	4 years

(continued)

LIST OF PREPARERS (concluded)

Name and Assignment	Education	Professional Experience
<u>Special Assistance</u>		
Donald Cain, Quality Control	BS Botany	17 years
Thomas Thompson, National Interests	BS Range	14 years
Helene Fairchild, Quality Control	AA English	30 years
Thomas Slater, Quality Control	MS Landscape Architecture	18 years
Dennis Curtis, Quality Control	BS Geography	12 years
Graphic Productions, Richfield, Utah	Simulations and Graphics	

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT
ARE SENT

SPECIAL INTEREST GROUPS

Atomic Industry Forum
Bunkerville Citizens' Advisory Council
California Historical Landmarks Advisory
Chemehuevi Indian Tribe
Citizens for Survival
Colorado River Indian Tribes
Desert Bighorn Council
Desert Fishes Council
Desert Protective Council
Desert Sportsman Rifle and Pistol
Desert Tortoise Council
Environmental Defense Fund
Fort Mojave Indian Reservation
Friends of Nevada Wilderness
Friends of the Earth
Gamblers Motorcycle Club
Goodsprings Citizens' Advisory Council
DES Environmental Defense Fund
High Uintas Wilderness Coalition
Houston Audubon Society
Huntington Botanical Garden
Isaac Walton League
ISSUE
Kaibab Indian Tribe
Las Vegas Bronco Club
Las Vegas Jeep Club
Las Vegas Tribal Council
League of Women Voters of Nevada
Logandale Citizens' Advisory Council
Los Angeles Audubon Society
Mesquite Citizens' Society
Mine Operators Association
Mint 400 Racing Headquarters
Moapa Citizens' Advisory Council
Moapa Indian Tribe
Motorcycle Racing Association of Nevada
National Audubon Society
National Outdoor Coalition
National Public Lands Task Force
National Resources Defense Council
National Wildlife Federation
Nature Conservancy
Nellis Rod and Gun Club
Nevada Cattlemen's Association
Nevada Frontloaders
Nevada Land Action Association
Nevada Public Land Users Association

Nevada Wildlife Federation
Nevada Woolgrowers Association
Oasis Motorcycle Club
Overton Citizens' Advisory Council
Public Lands Council
Quechan Indian Tribe
Red Rocks Audubon Society
Rimbenders Motorcycle Club
SCAG
Shamrocks Motorcycle Club
Sierra Club
Sierra Club Conservation Department
Sierra Club Legal Defense Fund
Sierra Club L.V. Group, Toiyabe Chapter
Sierra Club Utah Chapter
Silver City Scramblers
SNORE
SOURCE
Southern Council of Conservation Clubs
Southern Nevada Conservation Council
Southern Nevada Land Cruisers
Sportsman Racing Association
Spring Mountain Free Trappers
The Wilderness Society
United Mining Councils
Utah Audubon Society
Utah Environmental Center
Virgin Valley's Sportsmen's Association
Walt's Racing Association
Western Regional Council

LOCAL GOVERNMENTS, COMMISSIONS, AND ASSOCIATIONS

Boulder City, Mayor
Cedar City, Mayor
Clark County Commissioner
Coconino County Commissioner
Escalante, Mayor
Five-County Association of Governments
Garfield County Commissioner
Glendale Town Office
Henderson, Mayor
Hurricane, Mayor
Kanab, Mayor
Las Vegas, Mayor
Mojave County Commissioner
San Bernardino County Commissioner
Santa Clara, Mayor
St. George, Mayor
Toquerville, Mayor
Tropic, Mayor
Washington County Commissioner
Washington, Mayor

STATE GOVERNMENTS

Agriculture and Horticulture Commission
Antelope Valley Resource Conservation District
Arizona Division of Environmental Health
Arizona Economic Planning and Development
Arizona State Clearing House A-95
Arizona State Planning
Barstow Branch Library
California Department of Fish and Game
California Division of Highways
California Energy Commission
California Highway Commission
California Outdoor Recreation
California State Clearing House
California State Division of Mines and Geology
California State Lands Commission
California Wildlife Federation Board
Clark Conty Game Management Board
Energy Resources Conservation and Development
Governors of Arizona, California, Nevada, and Utah
Los Angeles Department of Water and Power
Mojave County Board of Supervisors
Mojave Water Department
Morango Basin Conservation Area
National Area and Trail Coordinator
Natural Resources Clinic
Nevada Department of Fish and Game
Nevada Division of Colorado River Resources
Nevada Division of Environmental Protection
Nevada Division of State Lands
Nevada Division of State Parks
Nevada Division of Water Resources
Nevada Highway Department
Nevada Public Services Commission
Nevada State Clearing House
Nevada State Engineer
Nevada State Planning
Riverside County Planning Commission
San Bernardino Association of Governments
San Bernardino County Board of Supervisors
San Bernardino County Building and Safety
San Bernardino County Museum
San Bernardino County Regional Parks Department
San Bernardino County Road Department
San Bernardino Planning Department
Southern California Air Pollution Control
State Legislatures of Arizona, California, Nevada, and Utah
Utah Association of Counties
Utah Department of Development Services
Utah Department of Natural Resources
Utah Department of Transportation
Utah Division of Health

Utah Division of Oil, Gas, and Mining
Utah Division of Parks and Recreation
Utah Division of State Lands
Utah Division of Water Resources
Utah Division of Wildlife Resources
Utah Energy Office
Utah Geological and Mineralogical Survey
Utah Planning Office
Utah State Clearing House
Utah Water Rights Division
Victorville Branch Library
Victorville Planning Commission
Washington County Water Conservancy District

FEDERAL GOVERNMENT AGENCIES

Army Corps of Engineers
BLM District Managers of Arizona Strip, Las Vegas, and Riverside
BLM State Directors of Arizona, California, Nevada, and Utah
Bonneville Power Administration
Bureau of Indian Affairs
Heritage Conservation and Recreation Service
Department of Energy
Environmental Protection Agency
Federal Aviation Administration
Federal Energy Administration
Federal Highway Administration
Federal Information Center
George Air Force Base
Advisory Council on Historic Preservation
National Park Service
 Bryce Canyon National Park
 Zion National Park
Office of the Solicitor
Rocky Mountain Regional Director, Federal Aviation Administration
U.S. Fish and Wildlife Service
U.S. Forest Service
 Angeles National Forest
 Dixie National Forest
 San Bernardino National Forest
U.S. Geological Survey
U.S. Soil Conservation Service
Western Area Power Administration
Western Office of Reviews and Compliance

CONGRESSIONAL DELEGATIONS

States of Arizona, California, Nevada, and Utah

UTILITIES AND COMMERCIAL VENTURES

Bingham Engineering
Bountiful Light and Power Company
City of St. George
Garkane Power Association, Inc.
General Telephone Company
Intermountain Consumer Power
Intermountain Power Project
Nevada Power Company
Pacific Gas and Electric
South Central Utah Telephone
Southern California Edison
Southern California Gas Company
St. George Utility Director
Union Pacific Railroad
Utah International, Inc.
Vaughn Hansen Associates
Washington County Water Conservancy District
Western States Water Council

APPENDIX 1
Scoping Meeting Rating Form

Name

Representing

Date

Direction 1. List at least five topics you believe should be discussed in the Allen-Warner Valley Environmental Impact Statement. These topics should be the ones you feel must be evaluated before a decision on the proposed energy project can be made. Please list the topics in their order of importance to you, i.e., the most important first, the second most important next, etc.

1. _____

2. _____

3. _____

4. _____

5. _____

Others _____

Direction 2. List below at least two alternatives (exclusive of the company's proposal) you believe should be evaluated in sufficient depth to permit their possible selection as the preferred environmental alternative. Please list the alternatives in their relative order of importance, i.e., the most important first, followed by the second most important, etc.

1.

2.

Others

APPENDIX 2

Screening Matrix for Alternative Selection

Alternatives Suggested during Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environ- mental Factors Need for Power	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environ- mentally Than Item Replaced	Meets Reasonable Criteria for EIS
1. Tax credits for power companies promoting conservation	Unknown	Yes	Yes	Yes	Unknown	Yes	No	Yes	No
2. Illok coal processing technique	Yes	Unknown	Unknown	Unknown	N/A	Unknown	No	Unknown	No
3. Upgrade Colorado River hydroelectric systems	Yes	Unknown	Yes	Yes	No	Yes	Yes	Yes	No
4. Solar energy from satellites	Unknown	Unknown	Unknown	Yes	Yes	Yes	No	Yes	No
5. Harness wave motion of the sea	Yes	Unknown	Unknown	Yes	Yes	Unknown	No	Unknown	No
6. Low fall dams on the Virgin River	Unknown	Yes	No	Yes	Unknown	Unknown	No	Unknown	No
7. Improve Parker Dam	Yes	No	Unknown	Yes	No	Unknown	Yes	Unknown	No
8. Construct the Kaiparowits project	Unknown	Yes	No	Unknown	Yes	Unknown	Yes	Unknown	No
9. Move well field west of Sevier Fault	Unknown	Yes	Yes	Unknown	N/A	Yes	No	Unknown	No
10. Amend environmental laws to permit development	Yes	N/A	N/A	No	Yes	Yes	Yes	No	No
11. Improve existing powerplants and mines	Yes	Unknown	Unknown	Yes	Unknown	Yes	No	Unknown	No
12. Use central Utah coal railroad to Harry Allen powerplant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13. Use Wyoming coal railroad to Harry Allen powerplant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(continued)

APPENDIX 2 (continued)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environ- mental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environ- mentally Than Item Replaced	Meets Reasonable Criteria for EIS
14. Use Lake Powell water for coal slurry- line	Unknown	Yes	Unknown	Yes	N/A	No	Yes	Yes	No
15. Construct smaller powerplants	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16. Construct power- plants at mines in central Utah	Yes	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
17. Build a 1,500-MW plant at Warner Valley and a 1,000-MW plant at Harry Allen	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
18. Construct Harry Allen plant in Los Angeles and use Colorado River water	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
19. Move all power- plants to Utah	Yes	Yes	Yes	Yes	Yes	Yes	No	Unknown	No
20. Construct power- plants in areas of electrical use	Yes	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
21. Company's proposal without Warner Valley powerplant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22. Build a 125-MW plant in Warner Valley and truck coal from Alton	Yes	Yes	Unknown	Yes	No	Unknown	Yes	Yes	No
23. Mine coal from Alton only by under- ground methods	Yes	Yes	No	Yes	N/A	Unknown	Unknown	Yes	No
24. Obtain coal else- where and ship by rail	Yes	Yes	Unknown	Yes	N/A	Unknown	No	Unknown	No

(continued)

APPENDIX 2 (continued)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
25. Construct power-plant at Alton	Unknown	Yes	Yes	Yes	Yes	Yes	No	No	No
26. Rail coal instead of using coal slurry	Yes	Yes	No	Yes	N/A	No	Yes	Unknown	No
27. Use energy conservation and alternate energy sources	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
28. Use coal gasification to produce electrical power	Yes	Unknown	Unknown	Yes	N/A	Unknown	No	Unknown	No
29. Use gasahol to produce electrical power	Yes	Unknown	No	Yes	N/A	No	No	Unknown	No
30. Use Lake Powell water to slurry Kaiparowits coal	Unknown	Yes	No	Yes	N/A	No	Yes	Unknown	No
31. Return AWT water to Colorado River	No	Yes	Yes	No	N/A	Yes	Yes	No	No
32. Reuse slurry water via return flow system	Yes	Yes	No	Yes	N/A	No	Yes	Unknown	No
33. Use California's share of Lake Powell water to slurry coal	No	Yes	Yes	Yes	N/A	No	Yes	Unknown	No
34. Use California's share of Lake Powell water to replace water taken from Alton area	No	Yes	Unknown	Yes	N/A	No	Yes	Unknown	No
35. Build Warner Valley reservoir for nonpower purposes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes
36. Enlarge Warner Valley reservoir	Yes	Yes	Unknown	Unknown	N/A	Unknown	Unknown	Unknown	No

(continued)

APPENDIX 2 (continued)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environ- mental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Energy Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously No Worse Environ- mentally Than Item Replaced	Meets Reasonable Criteria for EIS
37. Construct power- plants in California with rail coal	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
38. Construct power- plants in California with slurried coal	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Unknown	No
39. Expand Reid Gardner powerplant	Yes	Yes	Yes	Yes	Unknown	Yes	No	Yes	No
40. Construct a 2,000 MW powerplant at Alton	Unknown	Yes	Yes	Yes	Yes	Unknown	No	No	No
41. Construct power- plants elsewhere	Yes	Yes	Unknown	Yes	Yes	Unknown	No	Unknown	No
42. Construct a nuclear plant	Unknown	Yes	Unknown	Yes	Yes	Unknown	No	Unknown	No
43. Construct an oil- fired powerplant	Unknown	Yes	Unknown	Yes	Yes	Unknown	No	Unknown	No
44. Increase size of Harry Allen plant to 2,500 MW	No	Yes	Yes	Yes	Yes	Yes	Yes	Unknown	No
45. Expand existing energy systems	Unknown	Yes	Unknown	Yes	Unknown	Unknown	No	Unknown	No
46. Expand Colorado River hydroelectric system	Unknown	Yes	Unknown	Yes	Yes	Unknown	Unknown	Unknown	No
Additional Alternatives Suggested During Public Comment Period on Draft EIS									
47. Use saline waters of LaVerkin Springs to cool Warner Valley powerplant	Unknown	Yes	No	Yes	N/A	Unknown	No	Unknown	No
48. Use LaVerkin Springs water to slurry coal	Unknown	Yes	No	Yes	N/A	Unknown	No	Unknown	No

(continued)

APPENDIX 2 (concluded)

Alternatives Suggested During Scoping Procedures	Legally Acceptable	Technology Commercially Available by 1985	Economically Reasonable (No More Than 120% of Item Replaced)	Avoids or Minimizes Impacts or Enhances Other Environmental Factors	Meets a Major Portion of Applicant's Need for Power	Reasonably Efficient (No More Than 120% of Item Replaced)	Specific Enough to Permit an In-Depth Analysis	Obviously Worse Environmentally Than Item Replaced	Meets Reasonable Criteria for EIS
49. Use saline waters along Colorado River system for coal slurry	Unknown	Yes	Unknown	Unknown	N/A	Unknown	No	Unknown	No
50. Develop a multiple use rail system to haul Alton and Kaiparowits coal	Yes	Yes ^a	Yes	Yes	Yes	Yes	No	Unknown	No
51. Construct a transmission line from the Reid Gardner powerplant to St. George	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
52. Use IPP's DC lines to transmit power from the Warner Valley powerplant to California	Unknown	Yes	Unknown	Yes	Yes	Yes	No	Yes	No

^aDevelopment of this project would not occur until after 1985.

NOTE: N/A = Not applicable

APPENDIX 3

Government Depository Libraries that have Public Review Copies of U.S. Department of the Interior Environmental Impact Statements

A limited number of the environmental impact statements referenced in this document may be available upon request to the respective departmental offices and bureaus of the U.S. Department of the Interior that prepared the documents. Public reading copies are available for review at the following Government Depository Libraries:

GOVERNMENT DEPOSITORY LIBRARIES

Ralph Brown Draughon Library
Serials Dept. Auburn Library
Auburn, Alabama 36830

Arizona State University
College of Law Library
Tempe, Arizona 85281

Birmingham Public Library
2020 7th Avenue North
Birmingham, Alabama 35203

Arizona State University Library
Documents Service
Tempe, Arizona 85281

University of Alabama Library
P.O. Box 2600
Huntsville, Alabama 35807

University of Arizona Library
Documents
Tucson, Arizona 85721

University of Southern Alabama Library
Documents Division
Mobile, Alabama 36608

University of Arkansas Library
Reference Department
Fayetteville, Arkansas 72701

Hollis Burke Frissell Library
Tuskegee Institute
Tuskegee Institute, Alabama 36088

Arkansas State University
Dean B. Ellis Library
State University, Arkansas 72467

University of Alabama Library
Reference Department
Drawer S
University, Alabama 35486

• Humboldt State College Library
Arcata, California 95521

Anchorage Library
Z.J. Loussac Public Library
427 F Street
Anchorage, Alaska 99501

University of California
General Library
Documents Department
Berkeley, California 94720

Northern Arizona University Library
Government Documents Collection
Flagstaff, Arizona 86001

Pomona College Documents Collection
Honhold Library
222 East 9th Street
Claremont, California 91711

Department of Library & Archives
Attention: Director
3rd Floor State Capitol
Phoenix, Arizona 85007

West Hills Community College Library
300 Cherry Lane
Coalinga, California 93210

Phoenix Public Library
12 East McDowell Road
Phoenix, Arizona 85004

University of California Library
Government Documents Department
Davis, California 95616

University of California-Davis
School of Law Library
Davis, California 95616

Riverside Public Library
P.O. Box 468
Riverside, California 92502

California State College
Library at Hayward
25800 Hillary Street
Hayward, California 94542

University of California Library
P.O. Box 5900
Riverside, California 92507

University of California Library
Government Publications Department
P.O. Box 19557
Irvine, California 92713

California State Library
Documents Section
P.O. Box 2037
Sacramento, California 95809

University of California at San Diego
Library Documents Department
LaJolla, California 92093

California State University
2000 Jed Smith Drive
Sacramento, California 95819

J.F.K. Memorial Library
5151 State College Drive
Los Angeles, California 90032

San Diego Public Library
820 East Street
San Diego, California 92101

Los Angeles Public Library
Acquisitions
361 South Anderson
Los Angeles, California 90033

San Diego State University
Malcolm A. Love Library
San Diego, California 92182

University of California at Los Angeles
Library
403 Hilgard Avenue
Los Angeles, California 90024

San Francisco Public Library
Government Documents Department
San Francisco, California 94102

University of Southern California
Library
P.O. Box 77983
Los Angeles, California 90007

San Francisco State College
Government Publications
1630 Holloway Avenue
San Francisco, California 94132

U.S. Geological Survey Library
345 Middlefield Road
Menlo Park, California 94025

U.S. Court of Appeals Library
7th and Mission Streets
San Francisco, California 94101

California State University at Northridge
1811 Nordhoff Street
Northridge, California 91324

California State Polytechnical University
Library
San Luis Obispo, California 93401

University of California Library
Government Publications Section
Santa Barbara, California 93106

University of Denver Park Campus
Penrose Library
Denver, Colorado 80210

University of California
Library Documents Section
Santa Cruz, California 95060

Colorado State University Library
Fort Collins, Colorado 80523

Santa Rosa Sonoma County
Public Library
3rd & East Streets
Santa Rosa, California 95404

Colorado School of Mines
Arthur Lakes Library
14th & Illinois
Golden, Colorado 80401

Stanford University Libraries
Government Documents Department
Stanford, California 94305

University of Northern Colorado
Library Documents Room
Greeley, Colorado 80631

Adams State College
Learning Resources Center
Alamosa, Colorado 81101

Western State College
Leslie J. Savage Library
Gunnison, Colorado 81230

University of Colorado Library
Government Documents Division
Boulder, Colorado 80302

University of Southern Colorado
Library
2200 Bonforte Blvd.
Pueblo, Colorado 81001

Colorado College
Charles Leaming Tutt Library
Colorado Springs, Colorado 80903

Western Connecticut State College
Library
181 White Street
Danbury, Connecticut 06810

Auraria Libraries
Documents Department
Lawrence and 11th Streets
Denver, Colorado 80204

Connecticut State Library
231 Capitol Avenue
Hartford, Connecticut 06115

Denver Public Library
Documents Division
1357 Broadway
Denver, Colorado 80203

Yale University Library
Public Documents Room
New Haven, Connecticut 06520

Jefferson County Public Library
10200 West 20th
Denver, Colorado 80215

University of Connecticut
Wilbur Cross Library
Storrs, Connecticut 06268

Library of Congress
Depository Unit
Washington, D.C. 20240

Florida A&M University
Coleman Memorial Library
Tallahassee, Florida 32307

U.S. Department of the Interior
Office of Library Services
Serials Branch
Washington, D.C. 20240

Florida State University
R.M. Strozier Library
Tallahassee, Florida 32306

Delaware State College
William C. Jason Library
Dover, Delaware 19901

University of South Florida Library
4202 Fowler Avenue
Tampa, Florida 33620

University of Delaware
Morris Library
Newark, Delaware 19711

University of Georgia
Libraries
Athens, Georgia 30601

Wilmington Institute & Newcastle County
Library
10th & Market Streets
Wilmington, Delaware 19801

Georgia Institute of Technology
Price Gilbert Memorial Library
223 North Avenue NW
Atlanta, Georgia 30332

Florida Atlantic University Library
Division of Public Documents
Boca Raton, Florida 33432

Augusta College
Reese Library
2500 Walton Way
Augusta, Georgia 30904

Nova University Law Library
3301 College Avenue
Fort Lauderdale, Florida 33314

Brunswick Glyn City
Resource Library
208 Gloucester Street
Brunswick, Georgia 31520

University of Florida Library
Documents Department
Gainesville, Florida 36201

West Georgia College
Library Serials Department
Carrollton, Georgia 30118

University of Miami Library
Government Publications
P.O. Box 248214
Miami, Florida 33124

Mercer University
Stetson Memorial Library
1330 Edgemont Avenue
Macon, Georgia 31207

Selby Public Library
1001 Boulevard of the Arts
Sarasota, Florida 33577

Georgia Southern College
Rosenwald Library
Statesboro, Georgia 30458

University of Guam
R.F.K. Memorial Library
P.O. Box EK
Agana, Guam 96910

University of Chicago Library
1100 East 5th Street
Chicago, Illinois 60637

University of Hawaii Library
2550 The Mall
Honolulu, Hawaii 96822

Northern Illinois University
Swen Franklin Parson Library
DeKalb, Illinois 60115

University of Idaho Library
Documents Section
Moscow, Idaho 83843

Southern Illinois University
Lovejoy Memorial Library
Edwardsville, Illinois 62025

Idaho State University Library
Documents Department
Pocatello, Idaho 83201

Northwestern University Library
Government Publications Dept.
Evanston, Illinois 60201

Southern Illinois University
Morris Library
Documents Center
Carbondale, Illinois 62901

Macmurray College
Henry Pfeiffer Library
Jacksonville, Illinois 62650

Eastern Illinois University
Booth Library
Charleston, Illinois 61920

Western Illinois University Library
Macomb, Illinois 61455

Chicago Public Library
Technical Services Center
425 North Michigan Avenue
Chicago, Illinois 60611

Monmouth College Library
Monmouth, Illinois 61462

Field Museum of Natural History
Library
Roosevelt Rd. & Lake Shore Dr.
Chicago, Illinois 60605

Illinois State Library
Government Documents
Centennial Building
Springfield, Illinois 62706

John Crenar Library
Acquisitions Department
35 West 33rd Street
Chicago, Illinois 60616

University of Illinois Library
Documents Division
Room 2200
Urbana, Illinois 61801

Northeastern Illinois University Library
Bryn Mawr at St. Louis Avenue
Chicago, Illinois 60625

Indiana University Library
Documents Department
Bloomington, Indiana 47401

Fort Wayne Public Library
900 Webster Street
Fort Wayne, Indiana 46802

Iowa State University Library
Government Documents Dept.
Ames, Iowa 50010

Indiana Purdue University
Regular Campus Library
2101 East US 30 Bypass
Fort Wayne, Indiana 46805

University of Northern Iowa Library
Documents Collection
Cedar Falls, Iowa 50613

De Pauw University
Roy O. West Library
Greencastle, Indiana 46135

University of Northern Iowa
Library Documents Collection
Cedar Falls, Iowa 50613

Indiana State Library
Serials Section
140 North Senate Avenue
Indianapolis, Indiana 46204

Grinnell College Library
Grinnell, Iowa 50112

Purdue University Library
LaFayette, Indiana 47907

University of Iowa Library
Government Documents Department
Iowa City, Iowa 52242

Ball State University Library
Government Publications
Muncie, Indiana 47306

University of Kansas Library
Documents Collection
Lawrence, Kansas 66044

St. Josephs College Library
Rensselaer, Indiana 47978

Kansas State University Library
Documents Department
Manhattan, Kansas 66506

Earlham College
Lilly Library
Richmond, Indiana 47374

University of Kentucky
Government Publications Department
Lexington, Kentucky 40506

Indiana University at South Bend
Library
1825 Northside Boulevard
South Bend, Indiana 46615

Louisville Free Public Library
4th and York Streets
Louisville, Kentucky 40203

Indiana State University
Documents Library
Cunningham Memorial Library
Terre Haute, Indiana 47809

University of Louisville Library
Belknap Campus
Louisville, Kentucky 40208

Louisiana State University Library
Government Documents Department
Baton Rouge, Louisiana 70803

University of Maine
Raymond H. Fogler Library
Orono, Maine 04473

Southern University Library
So. Baton Rouge Post Office
Baton Rouge, Louisiana 70813

U.S. Naval Academy
Nimitz Library
Annapolis, Maryland 21402

Louisiana State University at Eunice
Ledoux Library
Eunice, Louisiana 70535

Enoch Pratt Free Library
400 Cathedral Street
Baltimore, Maryland 21201

University of Southwestern Louisiana
Library
USL Box 4 0199
LaFayette, Louisiana 70504

John Hopkins University
Milton S. Eisenhower Library
Baltimore, Maryland 21218

Northwestern State University
Watson Memorial Library
Natchitoches, Louisiana 71457

University of Maryland
McKeldin Library
College Park, Maryland 20740

Tulane University
Howard Tilton Memorial Library
New Orleans, Louisiana 70118

Station Library
NAS NATC Building
Patuxent River, Maryland 20670

University of New Orleans Library
Lake Front
New Orleans, Louisiana 70122

University of Lowell
Alumini Lydon Library
1 University Avenue
Lowell, Massachusetts 01854

Louisiana Technical University
Prescott Memorial Library
Ruston, Louisiana 71270

Library of Massachusetts
Goodell Library
Amherst, Massachusetts 01002

Nicholls State University
Library Documents Division
Thibodaux, Louisiana 70301

Boston College
Bapst Library
Boston, Massachusetts 02167

Maine Maritime Academy
Nutting Memorial Library
Castine, Maine 04421

Boston Public Library
Documents Receipts
Boston, Massachusetts 02117

Harvard College Library
Serials and Records Division
Boston, Massachusetts 02138

Michigan State University
Library Documents Department
East Lansing, Michigan 48824

Massachusetts Institute of Technology
Library
14 East 210
Boston, Massachusetts 02139

Oakland Community College
Martin L. King Learning Center
27055 Orchard Lake Road
Farmington, Michigan 48024

State Library of Massachusetts
State House
Boston, Massachusetts 02133

Calvin College Library
3207 Burton Street SE
Grand Rapids, Michigan 49506

Stonehill College
Cushing Martin Library
North Easton, Massachusetts 02356

Grand Rapids Public Library
Library Plaza
Grand Rapids, Michigan 49502

Albion College
Stockwell Memorial Library
Albion, Michigan 49224

Michigan Tech University
Library Documents Department
Houghton, Michigan 49931

University of Michigan
Harlan Hatcher Library
Ann Arbor, Michigan 48104

Western Michigan University
Dwight B. Waldo Library
Kalamazoo, Michigan 49001

Detroit Public Library
5201 Woodward Avenue
Detroit, Michigan 48202

Michigan State Library
Government Library, Law Building
525 West Ottawa Street
Lansing, Michigan 48913

University of Detroit Library
4001 West McNichols Road
Detroit, Michigan 48221

Monroe County Library
Documents Division
3700 South Custer Road
Monroe, Michigan 48161

Wayne State University
G. Flint Purdy Library
Detroit, Michigan 48202

Eastern Michigan University Library
Ypsilanti, Michigan 48197

Wayne State University
Law Library
468 West Ferry Street
Detroit, Michigan 48202

Mankato State College
Government Publications
Mankato, Minnesota 56001

Minneapolis Public Library
300 Nicollet Mall
Minneapolis, Minnesota 55401

University of Minnesota
Wilson Library
Documents Division
Minneapolis, Minnesota 55455

Carleton College Library
Northfield, Minnesota 55057

Saint Cloud State College
Library Documents
Saint Cloud, Minnesota 56301

Mississippi College School of Law
Library
P.O. Box 4008
Clinton, Mississippi 39058

Mississippi State College for Women
J.C. Fant Memorial Library
College Station Box E
Columbus, Mississippi 39701

University of Southern Mississippi
Library
Southern Station, P.O. Box 53
Hattiesburg, Mississippi 39401

Mississippi State University
Mitchell Memorial Library
State College, Mississippi 39762

University of Mississippi Library
Documents Department
University, Mississippi 38677

University of Missouri
Library Documents
Columbia, Missouri 65201

Southeast Missouri State University
Kent Library
CPE Girardeau, Missouri 63701

University of Missouri at Kansas City
General Library, Gov't. Documents
5100 Rockhill Road
Kansas City, Missouri 64110

University of Missouri at Rolla
Library Documents
Rolla, Missouri 65401

Southwest Missouri State College
Library
901 South National
Springfield, Missouri 65802

University of Missouri at St. Louis
Thomas Jefferson Library
8001 Natural Bridge Road
St. Louis, Missouri 63121

Eastern Montana College
Library Documents
Billings, Montana 59101

Montana State University Library
Bozeman, Montana 59717

University of Montana Library
Documents Department
Missoula, Montana 59801

Nebraska Library Commission
Nebraska Public Clearinghouse
1420 P Street
Lincoln, Nebraska 68557

University of Nebraska
D.L. Love Memorial Library
Lincoln, Nebraska 68508

University of Nebraska Library
60th & Dodge Street
Omaha, Nebraska 68182

University of Nevada in Las Vegas
James Dickinson Library
4505 Maryland Parkway
Las Vegas, Nevada 89154

University of Nevada Library
Government Publications
Reno, Nevada 89557

Franklin Pierce Law Center
Library
2 White Street
Concord, New Hampshire 03301

University of New Hampshire Library
Durham, New Hampshire 03824

Dartmouth College
Baker Library
Hanover, New Hampshire 03755

Bayonne Free Public Library
697 Avenue C
Bayonne, New Jersey 07002

Ramapo College Library
P.O. Box 542
Mahwah, New Jersey 07430

Rutgers University Library
Government Documents Department
New Brunswick, New Jersey 08901

Newark Public Library
5 Washington Street
Newark, New Jersey 07101

Rutgers State University
John Cotton Dana Library
185 University Avenue
Newark, New Jersey 07102

Princeton University
Library Documents Division
Princeton, New Jersey 08540

University of New Mexico
Zimmerman Library
Albuquerque, New Mexico 87131

New Mexico State University
Library Documents
P.O. Box 3475
Las Cruces, New Mexico 88001

New Mexico Highlands University
Donnelly Library
Las Vegas, New Mexico 87701

Eastern New Mexico University Library
Portales, New Mexico 88130

New Mexico State Library
P.O. Box 1629
Santa Fe, New Mexico 87501

New York State Library
Cultural Education Center
Empire State Plaza
Albany, New York 12230

State University of New York Library
Vestal Parkway East
Binghamton, New York 13901

State University of New York
Drake Memorial Library
Brockport, New York 14420

Fordham University Library
Public Documents Section
Bronx, New York 10458

Columbia University Libraries
420 West 118th Street, Room 327
New York, New York 10027

Brooklyn Public Library
Social Science Department
Grand Army Plaza
Brooklyn, New York 11238

New York Public Library
Astor Branch
476 5th Avenue
New York, New York 10018

Polytechnic Institute of Brooklyn
Spicer Library
33 Jay Street
Brooklyn, New York 11201

New York Public Library
Lenox Branch
476 5th Avenue
New York, New York 10018

Buffalo & Erie County
Public Library
Lafayette Square
Buffalo, New York 14203

New York University
Law Library
40 Washington Square South
New York, New York 10012

State University of New York
Lockwood Memorial Library
Buffalo, New York 14214

New York University Library
Documents Department 7th Floor
70 Washington South
New York, New York 10012

Saint Lawrence University
Owen D. Young Library
Canton, New York 13617

York Law Institute Library
120 Broadway
New York, New York 10005

Corning Community College
Arthur A. Houghton Jr. Library
Corning, New York 14830

State University of New York
Penfield Library
Oswego, New York 13126

Long Island University
B. Davis Schwartz Memorial Library
C.W. Post Center
Greenvale, New York 11548

Vassar College Library
Poughkeepsie, New York 12601

Colgate University Library
Reference Librarian
Hamilton, New York 13346

State University of New York Library
College at Purchase
Purchase, New York 10577

Queens Borough Public Library
Documents Librarian
89 11 Merrick Boulevard
Jamaica, New York 11432

University of Rochester Library
River Campus Station
Rochester, New York 14627

Southampton College Library
Montauk Highway
Southampton, New York 11968

State University of New York in Stony Brook
Main Library Documents
Stony Brook, New York 11790

Syracuse University Library
Documents Division
Syracuse, New York 13210

Nassau Library System
900 Jerusalem Avenue
Uniondale, New York 11553

Syracuse University Utica Rome
811 Court Street
Utica, New York 13502

Apalachian State University Library
Government Documents
Boone, North Carolina 28607

University of North Carolina Library
BA SS Division Documents
Chapel Hill, North Carolina 27514

University of North Carolina
Atkins Library Documents Department
UNCC Station
Charlotte, North Carolina 28223

Duke University
William R. Perkins Library
Durham, North Carolina 27706

East Carolina University
Library Documents Department
Greenville, North Carolina 27834

North Carolina State University
D.H. Hill Library
P.O. Box 5007
Raleigh, North Carolina 27607

University of North Carolina
William M. Randall Library
P.O. Box 3725
Wilmington, North Carolina 28401

North Dakota State University Library
Federal Documents Office
Fargo, North Dakota 58102

Ashland College Library
Ashland, Ohio 44805

Ashland College Library
Ashland, Ohio 44805

Ohio University Library
Documents Department
Athens, Ohio 45701

Public Library of Cincinnati
and Hamilton County
800 Vine Street
Cincinnati, Ohio 45202

University of Cincinnati Library
Serials Division
Cincinnati, Ohio 45221

Case Western Reserve University
Freiberger Library
11161 East Blvd.
Cleveland, Ohio 44106

Cleveland Public Library
325 Superior Avenue
Cleveland, Ohio 44114

Cleveland State University Library
1860 Chester Avenue
Cleveland, Ohio 44115

Ohio State Library
State Office Building
65 South Front Street
Columbus, Ohio 43215

Hiram College
Teachout Price Memorial Library
P.O. Box 98
Hiram, Ohio 44234

Kent State University Library
Documents Division
Kent, Ohio 44242

College of Steubenville
Starvaggi Memorial Library
Steubenville, Ohio 43952

Toledo Public Library
325 Michigan Street
Toledo, Ohio 43624

University of Toledo Library
2801 West Bancroft Street
Toledo, Ohio 43606

College of Wooster
Andrews Library
Technical Services
Wooster, Ohio 44691

Central State University
Library Documents Department
Edmond, Oklahoma 73034

University of Oklahoma Libraries
Documents Division
401 West Brooks
Norman, Oklahoma 73069

Oklahoma Department of Libraries
Government Documents
200 NE 18th Street
Oklahoma City, Oklahoma 73105

Oklahoma State University Library
Stillwater, Oklahoma 74074

Tulsa City County Library
400 Civic Center
Tulsa, Oklahoma 74103

University of Tulsa
McFarlin Library
600 South College
Tulsa, Oklahoma 74104

Southern Oregon College Library
1250 Sisiydu Blvd.
Ashland, Oregon 97520

University of Oregon Library
Documents Section
Eugene, Oregon 97403

Eastern Oregon College Library
LaGrande, Oregon 97850

Bonneville Power Administration Library
P.O. Box 3621
Portland, Oregon 97208

Portland State University Library
P.O. Box 1151
Portland, Oregon 97207

Oregon State Library
State Library Building
Salem, Oregon 97310

Oregon State University
Library Documents Division
State University, Oregon 97331

Lehigh University
Library 30
Bethlehem, Pennsylvania 18015

Dickinson College Library
Carlisle, Pennsylvania 17013

State Library of Pennsylvania
Government Publications Section
P.O. Box 1601
Harrisburg, Pennsylvania 17126

Franklin and Marshall College
Fackenthal Library
Lancaster, Pennsylvania 17604

Allegheny College
Reis Library
North Main Street
Meadville, Pennsylvania 16335

Drexel University Library
32nd & Chestnut Streets
Philadelphia, Pennsylvania 19104

Free Library of Philadelphia
Government Publications
Logan Square
Philadelphia, Pennsylvania 19103

University of Pittsburgh
Hilman Library
Documents Office
Pittsburgh, Pennsylvania 15260

Slippery Rock State College
Maltby Library
Slippery Rock, Pennsylvania 16057

Pennsylvania State University
Library Documents Section
University Park, Pennsylvania 16802

Westmoreland City Community College
Learning Research Center
Armbrust Road
Youngwood, Pennsylvania 15697

University of Puerto Rico
Library Documents Room
Mayaguez Campus
Mayaguez, Puerto Rico 00708

University of Puerto Rico
General Library
Documents & Maps Room
San Juan, Puerto Rico 00931

University of Rhode Island Library
Government Publications Office
Wakefield, Rhode Island 02881

Richland County Public Library
1400 Sumter Street
Columbia, South Carolina 29201

South Carolina State Library
Documents Librarian
P.O. Box 11469 Cap Station
Columbia, South Carolina 29211

University of South Carolina
Undergraduate Library
Columbia, South Carolina 29208

South Dakota School of Mines & Technology
Library
Rapid City, South Dakota 57701

Chattanooga Hamilton County
Bicentennial Library
1001 Broad Street
Chattanooga, Tennessee 37402

Tennessee Technological University
Jere Whitson Memorial Library
Cookeville, Tennessee 38501

University of Texas at Austin Library
Main Building 316
Austin, Texas 78712

East Tennessee State University
Sherrod Library Documents Department
University Station
Johnson City, Tennessee 37601

University of Texas Law Library
2500 Red River Street
Austin, Texas 78705

Memphis & Shelby County
Public Library
1850 Peabody Avenue
Memphis, Tennessee 38104

Lamar University Library
P.O. Box 10021
Beaumont, Texas 77710

Memphis State University
John W. Brister Library
Memphis, Tennessee 38111

East Texas State University Library
East Texas Station
Commerce, Texas 75428

Joint University Libraries
Government Documents Section
Nashville, Tennessee 37203

Dallas Public Library
1954 Commerce Street
Dallas, Texas 75201

Tennessee State Library and Archives
State Library Division
Nashville, Tennessee 37219

El Paso Public Library
Documents & Genealogy
501 North Oregon
El Paso, Texas 79901

University of the South
Jessie Ball Dupont Library
Sewanee, Tennessee 37375

University of Texas at El Paso
Library Documents Division
El Paso, Texas 79968

Texas A & M University Library
A & M College, Texas 77843

Houston Public Library
Julia Ideson Bldg.
500 McKinney
Houston, Texas 77002

University of Texas at Arlington
Library Documents
Arlington, Texas 76019

University of Houston Libraries
Documents Division
3801 Cullen Blvd.
Houston, Texas 77004

Texas State Library
U.S. Documents Section
P.O. Box 12927
Austin, Texas 78711

Texas Tech University Library
P.O. Box 4079
Lubbock, Texas 79409

Stephen F. Austin State University
Steen Library
Documents Department
Nacodoches, Texas 75962

North Texas State University Library
North Texas, Texas 76203

University of Texas at Dallas
Library
P.O. Box 643
Richardson, Texas 75080

San Antonio College Library
1001 Howard Street
San Antonio, Texas 78288

Trinity University Library
Documents Collection
715 Stadium Drive
San Antonio, Texas 78284

University of Texas at San Antonio
Library
San Antonio, Texas 78285

Baylor University Library
P.O. Box 6307 BU Station
Waco, Texas 76706

Utah State University
Library Documents Division
Logan, Utah 84321

Weber State College Library
3750 Harrison Blvd.
Ogden, Utah 84408

Brigham Young University
Lee Library
Documents & Map Section
Provo, Utah 84602

University of Utah
Law Library
Salt Lake City, Utah 84112

University of Utah
Marriott Library
Salt Lake City, Utah 84112

University of Vermont
Bailey Library
Burlington, Vermont 05401

Florence Williams Public Library
4950 King Street
Christiansted, Virgin Islands 00820

University of Virginia
Alderman Library
Public Documents
Charlottesville, Virginia 22903

University of Virginia
Law Library
Documents Department
Charlottesville, Virginia 22901

Old Dominion University
Documents Dept. University Library
5215 North Hamton Blvd.
Norfolk, Virginia 23508

U.S. Geological Survey Library
National Center Mail Stop
12201 Sunrise Valley Drive
Reston, Virginia 22092

Virginia Commonwealth University
James Brothers Cabell Library
901 Park Avenue
Richmond, Virginia 23220

Hollins College
Fishburn Library
Roanoke, Virginia 24020

College of William and Mary
Swen Library
Documents Department
Williamsburg, Virginia 23185

Western Washington State College
Wilson Library
516 High Street
Bellingham, Washington 98225

Eastern Washington State College
Library
Cheney, Washington 99004

Central Washington University
Library Documents Section
Ellensburg, Washington 98926

Washington State Library
Documents Section
Olympia, Washington 98501

Washington State University Library
Serial Record Section
Pullman, Washington 99163

Seattle Public Library
6th and Madison
Seattle, Washington 98104

University of Washington Library
Government Documents Center
Seattle, Washington 98195

University of Washington
Law Library
1100 NE Campus Parkway JB 20
Seattle, Washington 98195

Spokane Public Library
Reference Department
West 906 Main Avenue
Spokane, Washington 99201

Tacoma Public Library
Documents Division
1102 South Tacoma Avenue
Tacoma, Washington 98402

University of Puget Sound
Collins Memorial Library
1500 North Wagner
Tacoma, Washington 98416

Whitman College Library
Penrose Memorial Library
Walla Walla, Washington 99362

Davis & Elkins College Library
Elkins, West Virginia 26241

Glenville State College
Robert F. Kidd Library
Glenville, West Virginia 26351

Marshall University Library
Documents Librarian
1655 3rd Avenue
Huntington, West Virginia 25701

West Virginia University Library
Morgantown, West Virginia 26505

Lawrence University
Seeley G. Mudd Library
Documents Department
Appleton, Wisconsin 54912

Beloit College Libraries
Serials Documents Department
Beloit, Wisconsin 53511

State Historical Society Library
816 State Street
Madison, Wisconsin 53706

Milwaukee Public Library
814 West Wisconsin Avenue
Milwaukee, Wisconsin 53233

University of Wisconsin in Milwaukee
Library Documents
Milwaukee, Wisconsin 53201

Wisconsin State University
Forrest R. Polk Library
800 Algona Blvd.
Oshkosh, Wisconsin 54901

University of Wisconsin at Platteville
725 West Main Street
Platteville, Wisconsin 53818

University of Wisconsin at Stevens Point
Documents Section
Learning Resources Center
Stevens Point, Wisconsin 54481

Wisconsin State University
Jim Dan Hill Library
18th & Grand Avenue
Superior, Wisconsin 54880

Wyoming State Library
Supreme Court & Library Bldg.
Cheyenne, Wyoming 82201

University of Wyoming
Coe Library
Laramie, Wyoming 82070

APPENDIX 4

Applicants' Proposed Design and Operating Procedures

Air Quality

1. During the construction and operational phases of the AWW energy system project, fugitive dust from unpaved roads and other disturbed soil surfaces will be controlled by periodically sprinkling with water or by application of other suitable chemical dust suppression agents as required.

Effectiveness. The measure would decrease fugitive dust, depending upon frequency of application of water. Use of chemical dust suppression agents would provide less control, but would last much longer between applications.

2. Powerplant stack emissions will be controlled by utilizing a wet lime scrubber for sulfur dioxide (SO_2) and an electrostatic precipitator for particulates. Control of nitrogen oxides sufficient to meet EPA emission standards will be accomplished by boiler design. The SO_2 particulate removal systems must meet a Best Available Control Technology (BACT), which at a minimum will be as stringent as the New Source Performance Standards.

Effectiveness. SO_2 removal would be over 80-percent effective; particulate removal over 90-percent effective. NO_2 removal would be expected to be at the lower limit allowable because of operating efficiency requirements.

3. Within the powerplants, lime required for the SO_2 abatement system will be stored in silos equipped with bag filters. Lime handling and transfer will be in closed systems.

Effectiveness. This method of controlling lime storage and transfer would be completely effective in preventing introduction of lime into the atmosphere.

4. Fly ash from the powerplants will be confined to closed hoppers and silos and transported dry by pneumatic or mechanical methods in closed transfer systems until mixed with station wastewater and transferred to the waste disposal ponds.

Effectiveness. Handling fly ash in this manner would be 100-percent effective in preventing its introduction into the atmosphere except for a small amount that could possibly blow off disposal ponds after evaporation.

5. Wherever active and inactive coal inventories are stored dry, as in piles, a dust suppression system based on sprayed wetting and stabilization agents will be employed. Inactive coal storage piles will be compacted to eliminate windblown dust. Coal conveyors' enclosures and wet suppression for transfer points will provide BACT for the coal handling system.

Effectiveness. Dust suppression would be 80 percent or greater.

6. The coal slurry preparation plant will employ BACT for pollutant control, including dust and noise inhibitors.

Effectiveness. This commitment would insure meeting applicable pollution control standards.

7. A monitoring program will be used throughout the construction and operational phases of the project at both powerplants. This program will monitor

air quality (SO_2 , particulate matter, and nitrogen oxides), stack emissions, fugitive dust, noise, and the ecological effects resulting from the project in order to insure proper control of potential pollutants.

Effectiveness. The commitment to monitor air quality would allow identification of needs and insure meeting standards set for emission control.

Soils

1. Only areas where the excavated subsoil is unsuitable for the establishment of vegetation will stockpiling of topsoil be practiced. Prior to excavation of the pipeline ditch, not less than 6 inches of topsoil will be removed. After backfilling, the topsoil will be used to cover materials which are unsuitable to support plant life. These areas would be located by soil testing.

Effectiveness. Stockpiling topsoil would insure a higher probability of success in reclamation efforts. Degree of success would vary according to quality and quantity of topsoil available in conjunction with localized climatic conditions. Revegetation should reduce loss of soil through erosion after vegetation would become established.

2. Interceptor dikes for erosion control will be constructed on disturbed slopes 50 feet or longer. Where construction activities impair existing drainage systems, waterways will be restored or rerouted.

Effectiveness. The amount of erosion which would occur would be reduced, although degree of effectiveness cannot be determined at this time.

3. In areas characterized by unconsolidated earth where sidehill cutting will be required, new permanent slopes will not exceed a 33-percent grade (3:1 slope).

Effectiveness. Success would vary according to specific onsite conditions. Erosion would be reduced, however, amount cannot be determined at this time.

4. In critical areas such as the highly erodible dune lands, washes, and stream embankments, contours will be restored to conform with adjacent areas at the end of construction where possible.

Effectiveness. Such contouring would be nearly 100-percent effective in making the area blend into the surrounding land form. Success in erosion control could vary from near present conditions to substantially worse conditions, depending upon land form.

5. Where the slurry pipeline crosses highly erodible dune land and sand areas, straw or native grass hay at the rate of 2 tons per acre will be applied. The mulching material will be anchored to the soil by punching, disking, or by the application of a suitable tucking compound. This mulch will be applied immediately following construction.

Effectiveness. Mulching would greatly enhance the probability of revegetation success, as well as preventing soil erosion.

6. In construction of the Warner Valley dam, unusable material from foundation, dam, and outlet works excavation will be distributed within the reservoir area and eventually inundated by the reservoir waters.

Effectiveness. Once inundated, this material would be eliminated as a visual detraction.

7. The Warner Valley dam abutments and foundation will be grouted and sealed to control seepage under the embankment materials.

Effectiveness. Proper grouting and sealing would prevent failure of the dam due to seepage.

8. Unsuitable gypsiferous soils will not be used in the Warner Valley dam embankment.

Effectiveness. The possibility of dam failure due to subsidence or piping would be effectively reduced to near zero probability.

Vegetation

1. Prior to disturbance of surface areas, an inventory of threatened and endangered plant species will be accomplished, and necessary measures to mitigate possible impacts on such threatened or endangered species shall be agreed upon between the authorized representative of the company and the land manager.

Effectiveness. Mitigating measures to avoid impacts to threatened and endangered plant species could be 100-percent effective.

2. Specific revegetation techniques which are designed to increase the chances of successful revegetation include: seed bed preparation, which would give best possible moisture conditions for germination and plant development; fertilizer application on soils where analysis indicates that plant nutrient deficiencies will retard plant development and thus hinder successful revegetation; seed quality, seeding rates, and seeding methods.

Effectiveness. Reducing the amount of actual disturbance would reduce impacts. Reseeding or other revegetation would reduce impact from disturbance; however, an estimate of its effectiveness cannot be made at this time.

Wildlife

1. Plant facilities and waste disposal areas will be fenced to prohibit entry by larger terrestrial animals.

Effectiveness. Fencing would be 100-percent effective in preventing loss of these animals due to such hazards.

2. Electrical transmission lines under 230 kV will be constructed to meet Rural Electric Association standards for prevention of raptor electrocution.

Effectiveness. Construction to these standards would eliminate danger to raptors from electrocution.

3. Except for conductor stringing, powerline construction in desert bighorn sheep habitat areas will take place during the fall or early winter.

Effectiveness. Avoiding construction during these seasons will nearly eliminate disruption of the desert bighorn sheep breeding period. Some disruption from conductor stringing could result.

4. Wildlife guzzlers disturbed by construction of the project will be moved to specified locations outside the areas of construction activity.

Effectiveness. The availability of water for animals using these guzzlers would be preserved.

5. Prior to disturbance of surface areas, an inventory of threatened and endangered animal species will be accomplished, and necessary measures to mitigate possible impacts on such species shall be agreed upon between the authorized representative of the company and the land manager.

Effectiveness. Mitigating measures to protect threatened and endangered wildlife species would be expected to be nearly 100-percent effective.

Water Resources

1. Sanitation facilities capable of handling the maximum construction force will be provided. Equipment will include portable chemical toilets in remote areas, toilet trailers in some areas, and permanent toilet facilities in some major construction areas. Sanitary wastes will be disposed of by transporting to offsite disposal areas or from onsite packaged sewage treatment plants with effluent going to onsite evaporation ponds.

Effectiveness. Commitment to this stipulation would result in 100-percent mitigation of potential impacts to water resources.

2. All ponds for evaporation of wastewater, as well as sewage treatment, will be constructed of impervious materials to prevent leakage into the groundwater.

Effectiveness. Prevention of leakage into the ground water from this source could be up to 100-percent effective, depending on type of impervious material used.

3. Petroleum products from equipment and vehicles will be collected and disposed of.

Effectiveness. Waste petroleum products could be completely contained. The only potential for introduction into the environment would be at the disposal site.

4. Wastewater from concrete batch plants and from vehicles transporting concrete will be directed to evaporation ponds for impoundment and evaporation.

Effectiveness. Wastewater could be completely prevented from entering into ground or surface waters through proper construction of evaporation ponds.

5. The grade of all plant sites will be designed to channel runoff into an evaporation pond(s) so as to keep any contaminated waters onsite.

Effectiveness. This measure would be 100-percent effective in keeping contaminated waters onsite, provided evaporation ponds would be impermeable and of sufficient capacity.

6. The Virgin River crossing by the coal slurryline will be made during low or no-flow periods (July through October). At the crossing point, the pipeline will be coated with layers of reinforced gunite for added weight.

Effectiveness. Sediment concentration in the Virgin River due to construction activities would be negligible. The possibility of washout would be greatly reduced by application of gunite.

7. The coal slurry pipeline crossing of the Muddy River will be accomplished by boring under the existing channel without disturbing the river.

Effectiveness. This measure would be 100-percent effective in preventing sediment introduction into the Muddy River due to construction activities. The potential for pipeline washout would be nearly eliminated.

8. The amount of powerplant cooling tower drift will be limited in quantity by the use of cooling tower drift eliminators.

Effectiveness. Application of this measure would keep cooling tower drift within accepted limits.

Cultural Resources

1. Prior to disturbance of surface areas, the company will survey and inventory archaeological, historical, and cultural sites within the proposed area of disturbance. The inventory will be presented to the Bureau of Land Management. Data on archaeological and historical sites of significance will also be presented to the State Historic Preservation Officers of the various states for a determination of possible impacts on such sites.

Effectiveness. Evaluation and assessment of archaeological sites would insure that potential National Register Properties would not be disturbed or destroyed without the due consideration required by Executive Order 11593.

2. A qualified archaeologist will be onsite during initial ground disturbance except for transmission lines. Only transmission corridor areas of probable archaeological significance which have been found during the 100-percent center line walk through will be surveyed prior to construction. If an archaeological site is discovered, disturbance will be stopped until an evaluation of the site can be made. Subsequent actions will depend on the significance of the site encountered. The site will be either avoided or salvaged, as determined by a representative of the land manager.

Effectiveness. A professional archaeologist knowledgeable of the site locations would work with construction crews and point out the locations of sites to be avoided. This would achieve 100-percent effectiveness for site avoidance, and would preclude the necessity of marking sites in a conspicuous manner, thus reducing the potential of impacts from vandalism. Having an experienced archaeologist working with construction crews would markedly reduce impacts associated with the possibility of encountering buried sites. Such an individual could be expected to recognize a buried site almost immediately, whereas an equipment operator or supervisor might not recognize certain site types at all. However, even this measure would not be 100-percent effective, as a buried site would have to be cut into and exposed to some extent before it could be recognized.

3. Construction crews will not be permitted to use the Honeymoon Trail as a construction access road.

Effectiveness. This measure would eliminate the possible destruction by construction crews of dry lain rock walls along the Honeymoon Trail.

Land Use

1. A field representative of the company will represent the entire construction operation. All government or land owner interaction with the company will be through the field representative.

Effectiveness. Having one recognized individual with which to interact would eliminate most of the communication difficulties and misunderstandings that would be inherent when several individuals would become involved.

2. All construction and operational workers would be given a briefing on the environmental stipulations contained in the rights-of-way grant.

Effectiveness. Noncompliance with the stipulations through ignorance would be eliminated.

3. After construction and land rehabilitation have been completed, a joint compliance check of rights-of-way will be made by the construction manager and the land owner and/or administrator to determine compliance with the terms and conditions of the rights-of-way permits.

Effectiveness. Compliance with terms and conditions of the right-of-way permits would be assured.

4. The company will notify the Bureau of Land Management, U.S. Fish and Wildlife Service, and the State Fish and Game Agency of the construction schedules in each of the States through which the rights-of-way for the project are received.

Effectiveness. Agencies would be able to schedule any necessary action on their part.

5. Disturbances to existing structures and facilities (fences, cattle-guards, roads, watering and irrigation facilities, etc.) caused by construction activities will be kept to a minimum. Functional use of these facilities will be maintained at all times and will be permanently restored after construction.

Effectiveness. This measure would facilitate livestock handling and would prevent trespass by livestock across existing fence boundaries. Interruption of traffic, irrigation, etc., would be prevented. Immediate installation of such facilities would result in 100-percent effectiveness of this measure.

6. New or upgraded roads needed for construction will be developed according to the following criteria:

1. The minimum centerline radius of curvature shall be based on the turning radius required for the largest construction equipment.

2. Grades in excess of 15 percent shall be submitted to the land manager for review.

Effectiveness. Proper road design for the specific needs and terrain would be assured.

7. The existing access roads used to construct the Navajo-McCullough 500 kV and the Reid Gardner-Pecos 230 kV lines will be utilized to construct the parallel segments of the proposed power transmission lines.

Effectiveness. Using existing roads where possible would eliminate unnecessary new disturbance of the land surface, reducing impacts to soils, vegetation, aesthetics, etc., on approximately 168 miles of right-of-way.

8. After construction, temporary construction roads will be blocked off from public use unless the land owner and surface management agency specify otherwise.

Effectiveness. Blocking roads would prevent further surface disturbance from vehicle use and would allow faster rehabilitation of the disturbed area.

9. All primary and secondary access roads to plant sites and the coal mine shall be paved.

Effectiveness. Paving the principle roads would greatly reduce erosion and would prevent vehicle-created dust.

Recreation and Aesthetics

1. The station color scheme (except aluminum products) will be selected for compatibility with the surrounding environment.

Effectiveness. This measure would decrease visibility of the structures and lessen visual impact.

2. Where 500-kV transmission lines run in the same corridor as existing 500 kV lines, an effort will be made to place the towers of the new line as nearly opposite the towers of the existing line as possible in order to minimize the visual effect of the two transmission lines.

Effectiveness. Proper alignment of new towers would lessen visual impact by 50 to 75 percent.

3. During slurry pipeline construction when backfilling operations have been completed in rocky areas, surplus rock will be distributed over the entire right-of-way. Only large rocks that disrupt the continuity of the landscape will be removed and disposed of in borrow pits or other inconspicuous locations. In no case will a windrow be formed.

Effectiveness. The adverse impact to visual resources due to construction operations would be lessened, however, extent has not been determined.

4. Screen plantings of native trees thinned from adjacent areas will be made 200 to 300 feet on either side of where the slurry pipeline crosses a highway and where the area is presently wooded.

Effectiveness. Screen planting of native trees would be nearly 100-percent effective in eliminating visual intrusion of right-of-way, depending on terrain.

5. An interpretive signing program will be undertaken to place a sign at the previous location of the Skutumpah sawmill and a sign or several signs along the route of the old Alton-Kanab road where the route is visible from any new or improved project roads used by the public.

Effectiveness. Interpretive signing would be desirable, however, actual benefit has not been determined.

6. Where the adjacent land has soil cover, the slurry pipeline ditch will be covered with enough soil to allow for subsidence during the compaction process. Berms, other than those used for erosion control, will be eliminated.

Effectiveness. The pipeline would be less visible; however, remaining scars would be dependent on surrounding vegetation and success of revegetation efforts.

APPENDIX 5

Actions Required to Authorize the Applicants' Proposed Project and Reasonable Alternatives

Agency	Activity/Action	Alternatives					
		1	2	3	4	5	6
<u>Department of Defense</u>							
Army Corps of Engineers	Construction of diversion structure in the Virgin River (Permit).	X		X			
	Discharge of dredged material into the Virgin River (Permit).	X		X			
	Construction of coal slurry pipeline crossing the Virgin and Muddy Rivers (Permit).	X	X				
	Grant right-of-way for AWT Pipeline.	X	X	X		X	
Air Force							
<u>Department of the Interior</u>							
Fish and Wildlife Service	Issue biological opinion on threatened and endangered species in project area.	X	X	X			
Office of Surface Mining Reclamation and Enforcement	Approval of mining plan for coal lease areas in the Alton coal field.	X	X	X			
Bureau of Land Management Arizona	Grant coal slurry pipeline right-of-way.	X	X				
	Grant electrical transmission line right-of-way.	X		X			
California	Grant communications site right-of-way.	X	X	X		X	
	Grant electrical transmission line right-of-way and microwave right-of-way.	X	X	X		X	
(continued)							

(continued)

APPENDIX 5 (continued)

Agency	Activity/Action	Alternatives				
		1	2	3	4	5
Nevada	Grant coal slurry pipeline right-of-way.	X	X			
	Grant Harry Allen powerplant right-of-way or conduct land sale.	X	X	X	X	
	Grant electrical transmission line right-of-way.	X	X	X	X	
	Grant coal slurry pipeline right-of-way.	X	X			
Utah	Grant Warner Valley water project right-of-way.	X		X		
	Grant Warner Valley powerplant right-of-way or conduct land sale.	X		X		
	Grant electrical transmission line right-of-way.	X	X	X		
	Determine visibility impacts to Bryce Canyon and Zion National Parks.	X	X	X		
<u>Department of Transportation</u>						
Federal Aviation Administration	Airports - construction, alteration, activation, and deactivation.	X	X	X	X	
	Navigable airspace (special use airspace).	X	X	X	X	
	Approve proposed construction plans regarding aircraft safety	X	X	X	X	

(continued)

APPENDIX 5 (continued)

Agency	Activity/Action	Alternatives				
		1	2	3	4	5
<u>Environmental Protection Agency</u>	Issue PSD permit for the Warner Valley powerplant.	X		X		
	Issue PSD permit for the Harry Allen powerplant.	X	X	X	X	
	Approve rail freight rates for transport of coal.			X	X	
<u>Federal Power Commission</u>	Approve wholesale power rates.	X	X	X	X	
<u>Federal Communications Commission</u>	Grant operation permits.	X	X	X	X	
<u>Federal Energy Administration</u>	Approve the use of coal as the primary energy source in new steam-electric generating units.	X	X	X	X	
<u>State of Arizona</u>	Grant right-of-way for coal slurry pipeline.	X	X			
	Grant right-of-way for electrical transmission system.	X		X		
	Issue Encroachment Permit for crossing of State highways.	X	X	X		

(continued)

APPENDIX 5 (continued)

Agency	Activity/Action	Alternatives					
		1	2	3	4	5	6
<u>State of California</u>							
Various State Agencies	Issue Certificate of Public Convenience and Necessity.	X	X	X	X		X
	Issue Encroachment Permit for crossing of State highways.	X	X	X	X		
<u>State of Nevada</u>							
Various State Agencies	Issue Certificate of Convenience and Necessity.	X	X	X	X		X
	Issue Encroachment Permit for crossing State highways.	X	X	X	X		
	Grant water rights.	X	X	X	X		
	Grant coal slurry pipeline right-of-way.	X	X				
	Grant right-of-way for electrical transmission lines.	X	X	X	X		
<u>State of Utah</u>							
Various State Agencies	Issue pollution discharge permits.	X	X	X			
	Grant right-of-way for transmission lines.	X	X	X			
	Grant right-of-way for powerplant.	X		X			
	Grant right-of-way for coal slurry pipeline.	X	X				

(continued)

APPENDIX 5 (concluded)

Agency	Activity/Action	Alternatives				
		1	2	3	4	5	6
<u>State of Utah (continued)</u>						
	Grant right-of-way for reservoir site.	X		X		
	Grant water rights for reservoir and coal field.	X	X	X		
	Issue Encroachment Permit for crossing State highways.	X	X	X		
<u>Local Agencies</u>						
County Planning Commissions of: Grant construction permits.						
Kane County, Utah		X	X	X		X
Washington County, Utah		X		X	X	X
Clark County, Nevada		X	X	X		X
Lincoln County, Nevada		X	X	X		X
Mojave County, Arizona		X	X	X		
San Bernardino County, California		X	X	X		X
Los Angeles County, California					X	X
Washington County, Utah	Hold bond elections to authorize water project funding.	X				
St. George, Utah	Hold bond election to authorize Warner Valley powerplant funding.	X				X

APPENDIX 6

Standard Operating Procedures and Mitigating Measures

Compliance with the following standard operating procedures will apply to implementation of any alternative or combination thereof. Mitigating measures, which follow the standard operating procedures, are designed to avoid or minimize impacts that are specific to an alternative.

STANDARD OPERATING PROCEDURES

General

1. Uses of public lands not yet specifically addressed in this environmental impact statement (EIS) will be subject to further environmental assessment and possible modification by the authorized officer (AO).

Effectiveness. This intensive and specific evaluation would enable the Authorized Officer (AO) to reduce or mitigate most of the adverse environmental impacts associated with any proposed development.

2. Mining claims located on public lands will be adjudicated in accordance with proper procedures. Should the claim(s) be determined to be valid, a use arrangement satisfactory to the mining claimant must be developed between the grantee and the mining claimant.

Effectiveness. The mining claimants' interests would be considered.

3. An attempt will be made to accommodate the affected State governments to the extent possible with the arrangements made for the reduction of adverse socioeconomic and environmental impacts.

Effectiveness. Conflicts with the affected State governments would be minimized.

4. The grantee will do everything reasonable, both independently and/or upon request of the AO, to prevent and suppress fires caused by the grantee, his contractors or sub-contractors on or near the lands occupied. Federal, private, and State interests will be compensated by the grantee for suppression and rehabilitation expenses as per existing statutes.

Effectiveness. The possibility of fires would not be eliminated. Identifying liability for such fires may tend to make the grantee more cautious. Various interests would be protected against loss due to fire.

5. The grantee shall comply with applicable Federal, State, and local laws and all regulations issued thereunder affecting in any manner construction, operations, maintenance, or termination of the system.

Effectiveness. Commitment to this stipulation would enhance protection afforded by such laws and regulations.

6. The grantee shall take all measures to protect the health and safety of all persons affected by its activities performed in connection with the construction, operation, maintenance, and termination of the system, and shall immediately abate any health or safety hazards.

Effectiveness. Adherence to this stipulation would promote a safe work environment for employees and the general public.

7. Equipment repair areas and construction yards will be located at least 0.5 mile (0.8 km) from the nearest residence or business.

Effectiveness. This measure would reduce most of the annoyance from noise to businesses and residents of the area.

8. An adequate reclamation plan based on reclamation studies conducted at the expense of the grantee in accordance with 30 CFR, Part 211 and 30 CFR, Part 700 et seq. regulations will be prepared and followed by the applicant.

Effectiveness. Chances for reclamation success would be enhanced, though degree cannot be determined.

9. The grantee will provide botanists, archaeologists, paleontologists, wildlife biologists, and other specialists as appropriate (subject to approval of the A0), for all necessary surveys in areas to be disturbed by the project. These individuals must have the necessary valid permits or licenses. Separate permits shall be required for survey and mitigation excavation.

Effectiveness. This measure would provide consideration for sensitive values in the fields of profession identified. This would provide a high degree of protection for surface resources; somewhat less for subsurface resources.

10. All construction areas will be maintained in a neat and orderly condition at all times.

Effectiveness. Visual quality and safety would be enhanced.

11. Transmission lines will be maintained and repaired using the same or more environmentally acceptable techniques as used in the original construction.

Effectiveness. Using such techniques would be 100-percent effective in preventing resource damage of greater severity than that caused during original construction.

12. Final road and tower construction engineering specifications (including a centerline survey, tower-site surveys, substations and communications systems designs and locations, locations of borrow sites, stockpiling, and storage areas, specific drainage devices proposed, work schedule, needed equipment, rehabilitation measures, waste disposal methods, and sites specifically requested for deviations from those specifications) will be supplied in writing to BLM for study and approval 30 days prior to proposed construction.

Effectiveness. Such submission would provide sufficient time for necessary planning.

13. The company will notify BLM, U.S. Fish and Wildlife Service, and the State Wildlife Agency of the construction schedules at least 90 days in advance of any construction within that State. The company will also notify these agencies of any changes in schedule at least 30 days in advance of construction. In the case of changes in mining schedules, the company will notify OSM accordingly to the same time requirements.

Effectiveness. Notification as specified would provide adequate time for necessary action.

14. The applicant will be required to coordinate with the affected Federal, State, and local transportation authorities regarding road development.

Effectiveness. Conflicts with affected parties would be minimized.

15. Liquid and solid wastes must be disposed of according to provisions of the Resource Conservation and Recovery Act of 1976 (and amendments).

Effectiveness. Provisions are designed to protect elements of local ecosystems and human health and safety to the best means practical.

Air Quality

1. The applicant will be required to indicate a program to monitor power-plant trace element emissions for possible buildups in soils and vegetation. If trace element problems develop, based on fallout monitoring and concurrent bioassay work as performed by the grantee or identified by the responsible agency, the operations of the powerplants will be modified to eliminate these affects.

Effectiveness. Modification of the powerplants based on monitoring would be effective in preventing most of the trace element problems beyond those occurring up to the time of modification.

Soils

1. Water bars will be constructed on permanent dirt or gravel access roads to adequately divert runoff to natural drainages. The location of water bars will be determined by the AO. Roadside drainage ditches will be constructed on access roads to reduce water flow and velocity. Drainage ditches will be dug at intervals determined by the AO. Roads will be "out-sloped" as much as possible. Berms will be removed.

Effectiveness. This measure would be helpful in preventing or controlling erosion. The degree of effectiveness cannot be determined at this time.

2. Terracing, contour furrowing, mulching, sediment basins, sediment fences, and check-dams will be used to control local erosion and prevent offsite sedimentation as determined necessary by the AO.

Effectiveness. Such structures could be very effective in preventing erosion and sedimentation. The degree of effectiveness would depend on site specific conditions.

3. Scalping of topsoil will not be allowed except as approved by the AO. When scalping is allowed, suitable topsoil and subsoil will be scraped and stockpiled for reclamation use.

Effectiveness. The stockpiling and respreading of topsoil would make it possible to establish a suitable seedbed on about 140 miles of right-of-way.

4. Wherever possible, major drainages should be spanned, and access roads will be properly built in flood prone and flash flood areas to avoid erosion and gullyng. Caution will be exercised in the location of batch plants and pulling yards to avoid drainages during rainy periods.

Effectiveness. The degree of effectiveness cannot be determined at this time. However, significant erosion problems should be avoided.

Vegetation

1. Along transmission lines, removal of trees will be limited to those closer than 20 feet to an electrical power conductor. Whenever possible, clearing of trees creating a hazard should be done after conductor installations to minimize tree removal.

Effectiveness. Reducing the amount of right-of-way clearing by an estimated 85 percent on Federal land would substantially decrease the overall rate of soil erosion. Reducing the amount of actual soil disturbance would reduce potential destruction of rare and endangered plants and animals (both proposed and designated). There would also be a reduction in the disturbance of archaeological resources.

2. The applicants will be required to establish a vegetation cover within 5 years from the completion of construction on all disturbed areas designated by the AO. Species seeded, rate, and method of application will be approved by the AO.

Effectiveness. The commitment to artificially reestablish a vegetation cover would have a marginal degree of success. In areas where successful, artificial revegetation could be expected to provide a suitable ground cover within 5 years of construction, thereby reducing the time these areas would be subject to increased rates of soil erosion. Where artificial revegetation would not be successful, revegetation could require from 10 to 100 years.

Wildlife

1. No new main access roads will be permitted within the Clark Mountain Sensitive Area.

Effectiveness. This measure would minimize further impacts to values present in this area.

2. A field inventory of raptor nesting sites will be performed by a qualified raptor specialist provided by the applicant and approved by BLM if construction activities would be occurring during the sensitive nesting and brood period. If an active nesting site is in use, necessary measures to be taken shall be agreed upon between the AO and the grantee.

Effectiveness. This measure would minimize impacts on raptors in areas of construction.

3. The applicants or their contractors will construct one additional big game watering facility for each existing one within 300 yards (274 m) of construction activities in bighorn sheep habitat. These facilities are to be similar to the existing ones and located on the opposite side of the right-of-way. The type and location of each new watering facility will be determined in conjunction with the BLM and the State Wildlife Agency.

Effectiveness. Construction of these watering facilities would lessen impacts to the bighorn sheep. The degree of effectiveness cannot be determined at this time.

4. The grantee shall construct, maintain, operate, and/or modify structures and facilities as directed by the AO to protect and minimize adverse effects upon raptors and other wildlife.

Effectiveness. Proper design in construction, operation, and maintenance of structures and facilities would provide nearly complete protection of raptors. Other wildlife would be less affected by structures and facilities, however, measures taken to protect other wildlife would be less effective.

5. The grantee shall report any and all wildlife kills, including raptor electrocutions, discovered or reported on or near project facilities to the AO.

Effectiveness. Reporting of wildlife kills would aid in determining problem areas. Once the problem would be determined, corrective action could be taken; however, effectiveness would be highly variable.

6. Prior to exact route selection, BLM and the applicants will consult with Utah Division of Wildlife Resources to determine critical wildlife areas and construction timing.

Effectiveness. This measure would minimize disturbances to critical wildlife habitat.

Water Resources

1. The applicant will be required to install culverts or bridges at points where new permanent access roads will cross live streams. Where streams are crossed by temporary roads or culverts, they will be removed upon completion of the project. Any construction activity in a perennial stream will be prohibited unless specifically allowed by the appropriate Federal official. All stream channels and washes will be returned to as near their natural state as possible.

Effectiveness. This measure would be effective in preventing sedimentation in the stream except during installation of such culverts. Rehabilitation would meet with varying degrees of success, depending upon the site.

2. The applicant will be required to bury the slurryline in bedrock or at least 15 feet below the existing bed at Kanab Creek, Fort Pierce Wash, Virgin River, Beaver Dam Wash, Toquop Wash, Meadow Valley Wash, and the Muddy River. Shallower burial may be allowed where applicant can demonstrate in writing to BLM (through the use of adequate field studies and design) that the pipeline would not be exposed in the event of a 50-year flood.

Effectiveness. Burying the slurryline in bedrock or to a depth of 15 feet on river and wash crossings would nearly eliminate the possibility of a pipeline rupture due to flooding. Burying the pipeline at river and wash crossings would reduce the risks of adverse impacts to endemic fishes caused by slurry discharge.

3. The applicant will be required to install and maintain automatic pressure sensitive valves on both sides of river crossings, specifically at Kanab Creek, Fort Pierce Wash, and the Virgin River. The applicant will also be required to install and maintain valves on major wash crossings, specifically Fort Pierce Wash, Toquop Wash, Beaver Dam Wash, and Sand Wash. With BLM approval, this system could be modified, provided that the protection remained the same or improved.

Effectiveness. In the event of a break, check valves and sectionalized valving would reduce spill volumes to less than 0.02 acre-feet at the Virgin River crossing. This represents a 98-percent reduction in the maximum amount of slurry that could be discharged at this point. Similar reductions could be expected at other crossings where check valves would be installed. The intensity of ground water impacts would also be reduced by at least 50 percent due to sectionalized valving. Sectionalized valving would substantially reduce risks of adverse impacts to endemic fishes caused by the slurry discharge.

4. Blasting will be prohibited within 500 feet of all live springs, reservoirs, or water wells.

Effectiveness. The possibility of damage or loss of the water source would be greatly reduced.

5. The grantee shall not use water from springs, wells, seeps, creeks, or streams which have been appropriated to Federal agencies or other users without the written authorization from the AO or water right owner.

Effectiveness. The potential for conflicts arising over unauthorized use of water would be greatly reduced.

6. Any water used with the approval of the AO or water right owner shall be only for the specific purpose and duration described in the written authorization of the AO or water right owner.

Effectiveness. The potential for conflicts arising over unauthorized use of water would be greatly reduced.

7. The applicant will not construct holding ponds, liquid or solid waste disposal areas within 100 feet of tributary washes and their immediate flood plains.

Effectiveness. This measure would be effective in preventing a major spill of wastes into the environment.

Cultural Resources

1. If cultural sites are determined to exist as determined by cultural inventories performed by the grantee, measures to be taken to mitigate possible impacts will be agreed upon between the AO, the appropriate State Historic Preservation Officer (SHPO), and the grantee.

Effectiveness. The BLM would apply consistent management practices along the entire route for all archaeological and historical resources, conveying information to the SHPO or other agencies as appropriate. Regulatory conformance would be enhanced.

2. The applicant will provide a qualified paleontologist who will be approved by the AO. The paleontologist will conduct an intensive survey of all areas to be disturbed which are identified by the AO as having high potential for paleontological resources. Construction activities may be halted by the AO until appropriate action is determined.

Effectiveness. This measure would be effective in preventing damage to surface paleontological resources and in preventing damage to subsurface resources beyond that caused during discovery in those areas surveyed.

3. Prior to project approval, contemporary ethnic groups which may have special concerns for cultural resources in either proposed or alternative power transmission corridors will be consulted by the grantee in order to identify sites or areas of special religious significance. During construction through areas identified as having special religious significance to Native Americans, the applicant will provide for a Native American adviser (approved by the appropriate BLM District official) to help in avoiding the sensitive sites. The applicant will further insure that these groups will be kept informed of the progress of construction work and that any discoveries of archaeological, ethnographic, or historical value will be brought to the attention of such groups.

Effectiveness. This measure would be effective in providing that interests of such groups would be given consideration.

4. Prior to site specific mitigation of impacts to cultural resources, a memorandum of agreement shall be entered into between the applicant, the SHPO, and BLM.

Effectiveness. Such an agreement would enhance the probability that each agency would have input into determining the type of mitigation necessary.

5. For all sites located, the archaeological contractor shall provide the data necessary for determination of eligibility for inclusion to the National Register of Historic Places.

Effectiveness. This measure would provide the opportunity for all sites to be given proper consideration for inclusion on the National Register of Historic Places.

6. Should any one or parts of an alternative conflict with areas under consideration for programs of the Land and Water Conservation Fund, the applicant will negotiate with the Heritage Conservation and Recreation Service of the U.S. Department of the Interior for the development of mitigating measures and/or a resolution of the conflict.

Effectiveness. The integrity of Land and Water Conservation Fund programs would receive consideration.

Land Use

1. Upon revocation or termination of this grant, or termination of use of any part of the energy system located on public lands, the grantee shall remove all improvements and equipment, except as otherwise approved in writing by the AO, and shall restore the land to a satisfactory condition as determined by the AO.

Effectiveness. Abandoned improvements and equipment would be prevented from becoming an eyesore and/or safety hazard.

2. The grantee shall avoid areas subject to mudflows, landslides, mudslides, avalanches, rock falls, and other types of mass movements where practicable in locating the powerline and slurryline. Where such avoidance is not practicable, the powerline and slurryline design, based upon detailed field investigations and analysis, shall provide measures to prevent the occurrence of, or protect the powerline and slurryline against the effects of mass movements.

Effectiveness. Avoidance of or designing for such conditions would be effective in lessening associated dangers. Avoidance would be highly effective. Where avoidance would not be practical, effectiveness of design would be variable, subject to severity of any such mass movements.

3. No dumping of oil waste, toxic materials, solid or liquid wastes will be allowed except in authorized waste disposal sites. No burning of debris or waste materials will be allowed except as specifically authorized by the AO.

Effectiveness. This would protect against contamination of ground water and surface water and would prevent air pollution from these sources.

4. Specific sites (e.g., archaeological sites, areas with threatened and endangered species, fragile watershed, etc.), where construction equipment and vehicles will not be allowed will be clearly marked on the site by the AO before any equipment is brought in. The grantee will be responsible to

assure that construction personnel are well versed in recognizing these markers and that they understand the restrictions of equipment movement that are involved.

Effectiveness. This measure would enhance protection of identified sites.

5. Travel will be restricted to rights-of-way and existing public roads. Cross-country motor vehicle travel will be prohibited.

Effectiveness. This measure would reduce impacts on soil and vegetation outside access roads and immediate construction areas.

6. The grantee or permittee shall confine all activities within the area specifically defined in the right-of-way or permit.

Effectiveness. This measure would reduce impacts on soil and vegetation outside access roads and immediate construction areas.

7. Access roads needed to transport personnel and material will be of temporary nature only, and must be approved in writing by the AO prior to construction.

Effectiveness. This measure would greatly reduce unnecessary soil and vegetation disturbance and would help hold allowed disturbance to a minimum.

8. The grantee or permittee shall make application in accordance with applicable regulations for all proposed access roads not granted in the primary right-of-way or permit and located on public lands outside the permit or grant area.

Effectiveness. This measure would greatly reduce unnecessary soil and vegetation disturbance and would help hold allowed disturbance to a minimum.

9. Grantee will compensate livestock operators for privately owned permanent improvements lost due to project construction.

Effectiveness. The monetary investment of private parties would be protected.

10. The applicant will develop a plan acceptable to the Federal Aviation Administration for marking transmission lines in agricultural areas and aircraft traffic areas, such as airports, or will reroute facilities to such locations as acceptable to the Federal Aviation Administration.

Effectiveness. This measure would enhance the safety of those engaged in air traffic.

11. In areas designated by the AO where access across the terrain or management constraints preclude standard construction methods, helicopters will be used to erect towers and string conductors.

Effectiveness. Use of helicopters would keep surface disturbance to an absolute minimum in areas identified for such construction methods.

12. The only roads allowed in areas designated for construction using helicopter techniques (i.e., all major construction tasks accomplished by helicopter except final pulling and tensioning of the conductors) will be access roads to the pulling sites. The only other surface disturbances will be where tower foundations are to be installed.

Effectiveness. Use of helicopters would keep surface disturbance to an absolute minimum in areas identified for such construction methods.

13. On agricultural land, towers will be set adjacent to or on field boundaries to reduce the impact to farm operations and agricultural production. Where this is not possible, the towers will be set on or perpendicular to the row crops, where feasible, so that the transmission lines do not run diagonally to the crop rows.

Effectiveness. This measure would reduce impacts to farm operations by varying degrees, depending on the site specific situation.

14. Construction camps will be established only where the available community facilities cannot accommodate the construction work force. State sanitation laws will be adhered to if any such camps are established.

Effectiveness. This measure would greatly reduce unnecessary surface disturbance and possible contamination which could result from such development.

15. Rights-of-way will parallel existing corridors wherever possible, reducing impacts to land use since use in these areas has been established.

Effectiveness. This measure would reduce the impact on aesthetic quality from the addition of another corridor through the areas involved.

16. After construction activities are completed, the grantee or permittee shall not prohibit the public in general from using the grant or permit area for all lawful purposes which are not inconsistent with the use for which the grant or permit was issued.

Effectiveness. The rights of the general public to use publicly owned land would be protected.

17. The grantee or permittee will be allowed to regulate access and vehicle traffic as required to insure security and public safety during construction operations.

Effectiveness. Allowing the grantee to regulate access and vehicle traffic would be effective in providing for public safety and security during construction operations.

18. The grantee or permittee shall be responsible for providing and installing regulatory signs that are necessary for users of access roads. The location and type of sign shall be approved by the A0.

Effectiveness. The safety of the users of public roads would be enhanced.

19. The grantee or permittee shall permit free and unrestricted access over public lands for all lawful and proper purposes, except in areas designated as restricted by the grantee or permittee with the consent of the A0, in order to protect public safety, health, and facilities constructed on the right-of-way.

Effectiveness. The rights of the general public to use publicly owned lands, consistent with safety requirements, would be protected.

20. The grantee or permittee acknowledges and agrees that the issuance of this permit or grant is subject to the express condition that the exercise thereof will not unduly interfere with the management, administration or disposal by the United States of lands affected thereby or the full and safe utilization thereof by the United States, for necessary operations incident to such management, administration, or disposal for purposes which are not inconsistent with or will not defeat the objective of the grant.

Effectiveness. Commitment to this stipulation would protect the prerogative of the United States to manage public lands of the United States.

21. The grantee or permittee agrees and consents to the occupancy and use by the United States, its grantees, permittees, or lessees of any part of the permit or grant area not actually occupied or required by the project for purposes which are not in conflict with the grantees' or permittees' activities and use.

Effectiveness. Commitment to this stipulation would protect the prerogative of the United States to manage public lands of the United States.

22. The grantee or permittee agrees that all operations under this grant or permit shall comply with State and Federal laws concerning the use of poisonous or hazardous substances, including insecticides, herbicides, fungicides, rodenticides, and other similar substances. Prior to the use of such substances on or near the permit or grant area, the grantee or permittee shall obtain from the AO approval of a written plan for such use. The plan shall state the method of application and other information as the AO may require. All use of such substances on or near the grant or permit area shall be in accordance with the approved plan. If the use of a poison is prohibited by the Secretary of the Interior, it shall not be used. If use of a poison is limited by the Secretary of the Interior, it shall only be used in accordance with that limitation.

Effectiveness. Commitment to this stipulation would insure compliance with Federal and State laws in the use of poisonous or hazardous substances. It would not insure that environmental damage would be avoided where the use of such substances were allowed.

23. The grantee or permittee will avoid disturbance or removal of cadastral survey monuments and markers. Where construction operations require such removal and relocation, this will be accomplished by BLM or in accordance with detailed instructions prescribed by the AO. All costs for such operations will be borne by the grantee or permittee.

Effectiveness. This measure would greatly reduce the possibility of located survey monuments and markers being disturbed. There would remain a chance that unidentified monuments could be destroyed.

Recreation And Aesthetics

1. Cut and/or spoil slopes will be shaped to existing land contours. All natural drainages will be preserved.

Effectiveness. Shaping of cut and/or spoil slopes would be effective in blending these areas with the land form. However, visual impacts would remain due to vegetational differences.

2. All clearing of construction areas will be free form and will respond to the existing forms and shapes in the area (i.e., use of curvilinear shapes rather than rectilinear). Temporary sites will be kept as small as possible and will be located in areas of minimum vegetation and slope.

Effectiveness. This type of clearing would be effective in reducing visual impacts. However, degree would be site specific and cannot be determined at this time.

3. All exposed facilities will be painted with colors selected for compatibility with the surrounding environment except where human safety consideration would dictate otherwise.

Effectiveness. Visual impact of facilities would be lessened, though degree of effectiveness cannot be determined at this time.

4. Diversion dikes and liquid disposal pond berms will be constructed in such a manner as to slope gently into the adjacent undisturbed landscape. Slopes will not exceed 3:1. Berms will be revegetated, where possible with native vegetation. Riprapping with native rock will be utilized in those areas where berms and dikes may be eroded.

Effectiveness. A visual impact would remain, however, aesthetics would be improved to near existing conditions.

5. Blasting will not be done on Visual Resource Management (VRM) Class I and II lands if such activity is determined by the AO to have an adverse impact on VRM ratings.

Effectiveness. Impacts to VRM ratings would be avoided in the identified areas.

6. All conductors will be of nonspecular material unless otherwise approved by BLM/National Regulatory Commission. All lattice towers will be of steel with a dulled gray surface, or other "aesthetic towers" may be required in specific locations after the final tower locations are known. These measures are subject to overriding Federal Aviation Administration regulations.

Effectiveness. This measure would decrease visibility of wires and towers and would help to make them blend with the background.

7. Self-supporting lattice towers will be used instead of guyed delta towers in all areas of heavy off-road vehicle (ORV) use to eliminate collision with guy wires.

Effectiveness. The possibility of ORV collision with guy wires would be completely eliminated.

8. Reflective tape strips will be placed 2 feet (0.6 meters) above the ground on the outer sides of all tower legs, midway between tower legs on all four sides in areas of heavy recreational use.

Effectiveness. The towers would be more visible to nighttime users of the area, thus reducing the probability of a collision with towers. The possibility of collision would not be eliminated.

9. No paint or permanent discoloring agents will be applied to rocks or vegetation for indicating survey or construction activity limits, points, etc.

Effectiveness. This measure would eliminate impacts which would occur from such activity.

10. The AO will be consulted prior to construction on respective lands to select colors which help blend structures with the natural landscape.

Effectiveness. Through assurance that proper colors would be used, the visual impacts of structures upon the landscape would be lessened.

11. The applicant will use long spans to cross roads and highways with transmission lines and will cross at right angles where visual or environ-

mental damage is not increased. Towers will be placed as far back from the highways as possible, at least 500 feet (150 meters) where technically feasible, and vegetation between towers and the highways will not be cleared except for the access road. Requests for variances will be assessed on a case-by-case basis by the AO.

Effectiveness. Effectiveness would vary with the situation. Placing towers away from highways could help blend them with the landscape, or it could serve to make them a dominant feature of the landscape. Leaving vegetation would lessen impacts in either case.

12. The grantee will construct and maintain new communication sites only by helicopter on VRM Class I and II lands where no roads presently exist if road construction would affect VRM ratings. No new access roads will be allowed unless approved by the AO.

Effectiveness. Compatibility of new access roads with VRM guidelines would be enhanced.

13. Baffling of air intakes on the boiler air feed fans will be required to reduce noise.

Effectiveness. Baffling of air intakes would reduce noise levels.

MITIGATING MEASURES

Alternative 1

1. The coal slurry pipeline and any associated facilities will be rerouted in accordance with the relocation route report prepared by Engineering Management Inc. (1977) to mitigate impacts to the Honeymoon Trail, the Coral Pink Sand Dunes State Reserve, and the Black Dog Cave/Moapa-Muddy Archaeological Complex.

Effectiveness. Rerouting the slurry pipeline away from where the Honeymoon Trail descends the Hurricane Cliffs would negate adverse effects on that portion of the trail and would preserve the property in essentially the same condition as when nominated to the National Register of Historic Places. However, the valve station, with its 50-foot high microwave tower, and a landing strip would still be visible from the trail.

Placing the pipeline in the shoulder of the road where it would traverse the Coral Pink Sand Dunes State Reserve would confine disturbance to an existing transportation corridor and would avoid the impact on aesthetic quality from the addition of another corridor through the recreation area.

The rerouting of the pipeline would avoid the Black Dog Cave/Moapa-Muddy Complex, thus reducing the chance of adverse impacts due to increased access.

2. A through road in Warner Valley will be provided for public access.

Effectiveness. Public access would be assured through this measure.

3. The slurry pipeline will be routed away from Bloomington Cave. The use of explosives within 0.5 mile (805 meters) of the cave will not be permitted unless approved in advance by the authorized officer.

Effectiveness. Realignment of control of explosives near Bloomington Cave would effectively mitigate potential impacts to sightseeing near the cave and would prevent physical damage to the cave.

4. Construction activities will be conducted during the winter months at the crossing of U.S. 89 and Arizona 389, and where the pipeline would parallel the Yellowjacket Road in the Coral Pink Sand Dunes area. Highway I-15 will be crossed as late as possible in the summer, commensurate with the requirement to cross the Virgin River at low or no flow periods.

Effectiveness. Sightseeing and tourist activity is greatest during summer months. At major transportation crossings and especially in the Coral Pink Sand Dunes State Reserve, inconvenience, congestion, and detraction from the recreation experience would decline if periods of peak tourist activity would be avoided.

5. The applicant will be required to construct the diversion dam so that river flows below 40 ft³/s could not physically be diverted into Warner Valley reservoir.

Effectiveness. This measure would be 100-percent effective in protecting the existing water right of CP National Utilities Company for its hydro-electric powerplant diversion of 40 ft³/s.

6. The applicant will be required to bury the slurryline in bedrock or at least 15 feet below the existing bed at Kanab Creek, Fort Pierce Wash, Virgin River, Beaver Dam Wash, Toquop Wash, Meadow Valley Wash, and Moapa River. Shallower burial may be allowed where the applicant can demonstrate in writing to BLM that the pipeline would not be exposed in the event of a 50-year flood.

Effectiveness. Burying the pipe in bedrock or to a depth of 15 feet on river and wash crossings could eliminate the possibility of a pipeline rupture due to flooding. Burying the pipeline at river and wash crossings would reduce the risks of adverse impacts to endemic fishes caused by slurry discharge.

7. The applicant will be required to install and maintain automatic pressure sensitive valves on both sides of river and major wash crossings, specifically at Kanab Creek, Fort Pierce Wash, Virgin River, Moapa River, Toquop Wash, Beaver Dam Wash, and Sand Wash. With BLM approval, this system could be modified, provided that the protection remained the same or improved.

Effectiveness. In the event of a break, check valves and sectionalized River crossing. This would represent a 98-percent reduction in the maximum amount of slurry that could be discharged at this point. Similar reductions could be expected at other crossings where check valves would be installed. The intensity of ground water impacts would also be reduced by at least 50 percent due to sectionalized valving. Sectionalized valving would substantially reduce risks of adverse impacts to endemic fishes caused by the slurry discharge.

8. The applicant will landscape in areas of high potential visual resources to prevent detracting from the natural landscape, especially where the powerplant would impact the Honeymoon Trail and the Dominguez-Escalante Trail in Warner Valley.

Effectiveness. Visual impacts would be lessened, although degree cannot be determined at this time.

Alternative 2

1. The coal slurry pipeline and associated facilities will be rerouted in accordance with the relocation route report prepared by Engineering Management Inc. (1977) to avoid damage to the Honeymoon Trail, the Coral Pink Sand Dunes State Reserve, and the Black Dog Cave/Moapa-Muddy Archaeological Complex.

Effectiveness. Refer to Alternative 1, mitigating measure 1.

2. Construction activities will be conducted during the winter months at the crossing of U.S. 89 and Arizona 389, and where the pipeline parallels the Yellowjacket Road in the Coral Pink Sand Dunes area. Highway I-15 will be crossed as late as possible in the summer, commensurate with the requirement to cross the Virgin River at low or no flow periods.

Effectiveness. Refer to Alternative 1, mitigating measure 4.

3. The applicant will be required to bury the slurryline in bedrock or at least 15 feet below the existing bed at Kanab Creek, Fort Pierce Wash, Virgin River, Beaver Dam Wash, Toquop Wash, Meadow Valley Wash, and Moapa River. Shallower burial may be allowed where the applicant can demonstrate in writing to BLM that the pipeline would not be exposed in the event of a 50-year flood.

Effectiveness. Refer to Alternative 1, mitigating measure 6.

4. The applicant will be required to install and maintain automatic pressure sensitive valves on both sides of river and major wash crossings, specifically at Kanab Creek, Fort Pierce Wash, Virgin River, Moapa River, Toquop Wash, Beaver Dam Wash, and Sand Wash. With BLM approval, this system could be modified provided that the protection remained the same or improved.

Effectiveness. Refer to Alternative 1, mitigating measure 7.

Alternative 3

1. A through road in Warner Valley will be provided for public access.

Effectiveness. Refer to Alternative 1, mitigating measure 2.

2. The applicant will be required to construct the diversion dam so that river flows below 40 ft³/s could not physically be diverted into Warner Valley reservoir.

Effectiveness. Refer to Alternative 1, mitigating measure 5.

Alternatives 4, 5, and 6

No mitigating measures apply to these alternatives. However, the standard operating procedures as presented in Appendix 4 would apply where appropriate.

APPENDIX 7

Vegetation Species of Concern in the States of Arizona, California, Nevada, and Utah

	<u>Common Name</u>
<u>ARIZONA</u>	
Cactaceae	
<u>Pediocactus sileri</u> E	Siler pincushion cactus
<u>CALIFORNIA</u>	
Amaryllidaceae	
<u>Androstephium breviflorum</u>	Short-flowered androstephium
Apiacea	
<u>Cymopterus deserticola</u>	Desert cymopterus
<u>Cymopterus gilmannii</u>	Gilman's cymopterus
Asteraceae	
<u>Enceliopsis nudicaulis</u>	Naked-stemmed daisy
<u>Eriophyllum mohavense</u>	Barstow eriophyllum
<u>Hemizonia mohavensis</u>	Mojave tarweed
<u>Perityle megaloccephala</u>	No common name
<u>Tetradymia argyraea</u>	No common name
Cactaceae	
<u>Echinocactus polycephalus</u>	Cottontop cactus
<u>Opuntia basilaris</u>	No common name
var. <u>brachyclada</u>	
Caryophyllaceae	
<u>Scopulophila rixfordii</u>	Rixford rockwort
Ephedraceae	
<u>Ephedra funerea</u>	Death Valley joint fir
Fabaceae	
<u>Astragalus cimae</u> var. <u>cimae</u>	Cima rattleweed
<u>Dalea arborescens</u>	Mojave dalea
Liliaceae	
<u>Calochortus striatus</u>	Alkali mariposa lily
Loasaceae	
<u>Mentzelia leucophylla</u>	No common name
Loganiaceae	
<u>Buddleja utahensis</u>	Utah buddleia
Malvaceae	
<u>Sphaeralcea rusbyi</u> var. <u>eremicola</u>	Rusby desert mallow

Papavaraceae	
<u>Arctomecon merriamii</u>	Merriam bear poppy
Poaceae	
<u>Bouteloua trifida</u>	Mojave grama
<u>Enneapogon desvauxii</u>	Nine-awned pappus grass
<u>Erioneuron pilosum</u>	Hairy Allen tridens
<u>Puccinellia parishii</u>	Parish alkali grass
<u>Stipa arida</u>	Needlegrass
Polemoniaceae	
<u>Linanthus arenicola</u>	No common name
Polygonaceae	
<u>Chorizanthe spinosa</u>	Mojave spine-flower
<u>Eriogonum heermanni</u> var. <u>floccosum</u>	Clark Mountain eriogonum
Scrophulariaceae	
<u>Penstemon stephensii</u>	Stephen's penstemon
Simaroubaceae	
<u>Castela emoryi</u>	Crucifixion thorn
NEVADA	
Agavaceae	
<u>Agave utahensis</u> var. <u>eborispina</u>	No common name
<u>Agave utahensis</u> var. <u>nevadensis</u>	Pygmy agave
Asteraceae	
<u>Enceliopsis nudicaulis</u>	Naked-stemmed daisy
var. <u>corrugata</u>	
<u>Haplopappus brickcelliodes</u>	Brickellia-like goldenweed
Chenopodiaceae	
<u>Atriplex hymenelytra</u>	Desert Holly
Boraginaceae	
<u>Cryptantha tumulosa</u>	Pinyon forget-me-not
Cactaceae	
<u>Coryphantha rosea</u>	No common name
Ephedraceae	
<u>Ephedra funerea</u>	Death Valley joint fir
Fabaceae	
<u>Astragalus geyeri</u> var. <u>triquetrus</u>	variety of Geyer's locoweed
<u>Astragalus lentiginosus</u> var. <u>latus</u>	variety of Freckled milkvetch
Hydrophyllaceae	
<u>Phacelia anelsonii</u>	Aven Nelson scorpion weed
Nyctaginaceae	
<u>Abronia orbiculata</u>	No common name

Papavarafeae	
<u>Arctomecon merriamii</u>	Merriam bear poppy
Polemoniafeae	
<u>Gilia ripleyi</u>	Ripley gilia
UTAH	
Apiaceae	
<u>Cymopterus minimus</u>	Least cymopterus
Asclepicdaceae	
<u>Asclepias welshii</u>	Welsh milkweed
Asteraceae	
<u>Aloysia wrightii</u>	Spicebush
<u>Erigeron religiosus</u>	Religious fleabane
<u>Hulsea heterochroma</u>	Great hulsea
<u>Parthenium tincanum</u>	Mariola
<u>Townsendia aprica</u>	Last chance townsendia
Brassicaceae	
<u>Lesquerella rubicundula</u>	Bryce bladderpod
Cactaceae	
<u>Echinocactus polycephalus</u>	Cottontop cactus
<u>Echinocereus englemannii</u> var. <u>purpureus</u> E	Purple-spined hedgehog cactus
<u>Pediocactus sileri</u> E	Siler pincushion cactus
Fabaceae	
<u>Astragalus ampullarius</u>	Sumpo milkvetch
<u>Astragalus striatiflorus</u>	Escarpment milkvetch
<u>Astragalus subcinereus</u> var. <u>basalticus</u>	Basaltic silver milkvetch
Hydrophyllaceae	
<u>Phacelia anelsonii</u>	Aven Nelson scorpionweed
<u>Phacelia cephalotes</u>	Virgin scorpion plant
Loasaceae	
<u>Petalonyx parryi</u>	Parry sandpaper bush
Onagraceae	
<u>Epilobium nevadense</u>	Nevada willowherb
Papavaraceae	
<u>Arctomecon humilis</u> E	Dwarf bearclaw poppy

NOTE: E = Species designated as "officially listed as endangered" by the U.S. Fish and Wildlife Service

APPENDIX 8

Wildlife Species of Concern in the States of Arizona, California, Nevada, and Utah

ARIZONA

Scientific Name

Birds

Bald Eagle - Federally listed
Peregrine Falcon - Federally listed
Black Hawk - State and BLM sensitive
Snowy Egret - State and BLM sensitive
Black Crowned Night Heron - State and BLM sensitive

Haliaeetus leucocephalus
Falco peregrinus anatum
Buteogallus anthracinus
Egretta thula
Nycticorax nycticorax

Mammals

Bighorn Sheep - State and BLM sensitive
Spotted Bat - State and BLM sensitive

Ovis canadensis
Euderma maculatum

Fishes

Virgin River Spinedace - State and BLM sensitive

Lepidomeda mollispinis
mollispinis

Reptiles

Desert Tortoise - State and BLM sensitive
Gila Monster - State and BLM sensitive

Gopherus agassizi
Heloderma suspectum

CALIFORNIA

Birds

Bald Eagle - Federally listed
Peregrine Falcon - Federally listed
Brown Pelican - Federally listed
Aleutian Canada Goose - Federally listed
Yuma Clapper Rail - Federally listed
California Blackrail - State sensitive
California Yellow-Billed Cuckoo - State sensitive

Haliaeetus leucocephalus
Falco peregrinus anatum
Pelecanus occidentalis
Branta canadensis leucopareia
Rallus longirostris yumanesis
Laterallus jamaicensis
Coccyzus americanus

Mammals

Mojave Ground Squirrel - State sensitive
California Bighorn Sheep - State sensitive

Spermophilus mohavensis
Ovis canadensis

Fishes

Mojave Chub - Federally listed

Gila mohavensis

Reptiles

Desert Slender Salamander - Federally listed
Tehachapi Slender Salamander - State sensitive
Black Toad - State sensitive
Desert Tortoise - BLM sensitive

Scientific Name

Batrachoseps aridus
Batrachoseps stebbinsi
Bufo exsul
Gopherus agassizi

NEVADA

Birds

Bald Eagle - Federally listed
Peregrine Falcon - Federally listed
Golden Eagle - State sensitive
All Hawks and Owls - State protected

Haliaeetus leucocephalus
Falco peregrinus anatum
Aquila chrysaetos

Mammals

Spotted Bat - State and BLM sensitive
Desert Bighorn Sheep - BLM sensitive

Euderma maculatum
Ovis canadensis

Fishes

Moapa Dace - Federally listed
Woundfin Minnow - Federally listed
Virgin River Spinedace - State and BLM sensitive

Moapa coriacea
Plagopterus argentissimus
Lepidomeda mollispinis
mollispinis

Reptiles

Gila Monster - State and BLM sensitive
Desert Tortoise - State and BLM sensitive

Heloderma suspectum
Gopherus agassizi

UTAH

Birds

Bald Eagle - Federally listed
Peregrine Falcon - Federally listed
Bell's Vireo - BLM sensitive

Haliaeetus leucocephalus
Falco peregrinus anatum
Vireo bellii arizonae

Mammals

Blackfooted Ferret - Federally listed
Utah Prairie Dog - Federally listed

Mustela nigripes
Cynomys parvidens

Fishes

Colorado Squawfish - Federally listed
Woundfin Minnow - Federally listed
Humpback Chub - Federally listed
Bonytail Chub - Federally listed

Ptychocheilus lucius
Plagopterus argentissimus
Gila cypha
Gila elegans

Virgin River Spinedace - BLM sensitive
Virgin River Roundtail Chub - BLM sensitive

Lepidomeda mollispinis
mollispinis
Gila robusta seminuda

Reptiles

Scientific Name

Gila Monster - State and BLM sensitive
Desert Tortoise - Federally listed
Desert Iguana - BLM sensitive

Heloderma suspectum
Gopherus agassizi
Dipsosaurus dorsalis

Snails

St. George Snail - BLM sensitive

Fontelicella deserta

APPENDIX 9

Cultural Resources Memorandums of Understanding with States of Arizona, California, Nevada, and Utah, and the Action Plan for Compliance with Advisory Council Procedure for Protection of Historic and Cultural Properties

CULTURAL RESOURCES MEMORANDUM OF UNDERSTANDING ALLEN-WARNER VALLEY ENVIRONMENTAL IMPACT STATEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT AND THE STATE OF ARIZONA

I. PURPOSE

The Bureau of Land Management, hereinafter referred to as the Bureau, is preparing the Environmental Impact Statement under the provisions of the National Environmental Policy Act of 1969. The Bureau has determined that cultural values could be damaged or lost as a result of actions proposed in the AWV EIS. The following kinds of actions are proposed on public lands administered by the Bureau:

- a. Non-Bureau Energy Initiative (NBEI) proposals submitted to the Bureau. These include proposals for rights-of-way and other land uses involving the surface of public lands
- b. Major transportation network proposals in connection with powerplant operation.
- c. Alternatives to the proposals.

The Arizona State Historic Preservation Office, hereinafter referred to as the State, is interested in assuring that cultural values in Arizona be protected. The Bureau and the State have consulted and agree as to the measures, outlined in this agreement, which should be undertaken to protect these values should authorization be granted to use public lands in Arizona administered by the Bureau for the purpose of any of the above mentioned proposed actions. In this agreement, "cultural resources" mean data and sites which have archaeological, historical, architectural, or cultural importance and interest.

Investigators will be qualified to evaluate these "cultural resources." Qualifications of investigators will be submitted to the State Historic Preservation Officer.

II. AUTHORITY

This agreement is authorized under the Federal Land Policy and Management Act of 1976 and the National Historic Preservation Act of 1966. It is in accord with Bureau policies and programs. It

does not abrogate nor amend any other agreement between the Bureau and the State.

III. RESPONSIBILITIES AND PROCEDURES

The Bureau will comply with 36 CFR 800 in identifying sites which are listed in or eligible for inclusion in the National Register of Historic Places.

- A. As part of the planning and environmental analysis required prior to any decision to authorize right-of-way, the Bureau will search for archaeological and historical literature concerning the AWW area.
- B. After completing the planning and environmental analysis process, should the proposed management be implemented, the Bureau will inform project participants of, monitor compliance with, and enforce the following stipulations:
 - 1. Prior to initiation of ground-disturbing activities, literature searches and intensive surveys will be undertaken on all areas which would be disturbed.
 - 2. Wherever possible and feasible, cultural resources will be avoided by construction and related activities. This will be accomplished mainly by rerouting linear facilities such as transmission lines, roads, fences, and pipelines, and adjusting locations of other facilities.
 - 3. A professional archaeologist may be required to be present when ground-disturbing operations are underway.
 - 4. Subsurface cultural remains that are encountered during any construction will be professionally recovered if there is no other recourse in such a situation.
- C. Wherever it is not possible and feasible to avoid sites that contain cultural values, the Bureau will consult with the State to determine the most satisfactory means of mitigating damage, as required by 36 CFR 800.
- D. The Bureau will provide cultural resources reports, technical reports, and other pertinent material to the State.

IV. The attached project description identifies the actions that the Bureau anticipates will be included in the description. This may be brought up to date, as necessary, without amending this agreement in any way.

V. IMPLEMENTATION

- A. This agreement will become effective on the date of the last signature on this agreement.
- B. Either party may request revision or cancellation of this agreement by written notice, not less than 30 days prior to the time when such action is proposed.
- C. Any problems resulting from this agreement which cannot be resolved by the Bureau and the State will be dealt with pursuant to the regulations of the Advisory Council on Historic Preservation, 'Protection of Historic and Cultural Properties' (36 CFR Part 800)."

FEB 14 1980

Date

Tom Allen Acting
Arizona State Director
Bureau of Land Management
Department of the Interior

28 Mar 1980

Date

Je Myers
Arizona State Historic
Preservation Officer

CULTURAL RESOURCES
MEMORANDUM OF UNDERSTANDING
ALLEN-WARNER VALLEY ENVIRONMENTAL IMPACT STATEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT
AND
THE CALIFORNIA STATE OFFICE OF HISTORIC PRESERVATION

I. PURPOSE

The Bureau of Land Management, hereinafter referred to as the Bureau, is preparing an Environmental Impact Statement under the provisions of the National Environmental Policy Act of 1969. The Bureau has determined that cultural values could be damaged or lost as a result of actions proposed in the AWV EIS. The following kinds of actions are proposed on public lands administered by the Bureau:

- a. Non-Bureau Energy Initiative (NBEI) proposals submitted to the Bureau. These include proposals for right-of-way and other land uses involving the surface of public lands.
- b. Major transportation network proposals in connection with powerplant operation.
- c. Alternatives to the proposal.

The California State Historic Preservation Officer, hereinafter referred to as the State, is responsible for assuring that full considerations are given to cultural values in California. The Bureau and the State have consulted and agree as to measures, outlined in this agreement, which should be undertaken to protect these values should authorization be granted to use public lands in California administered by the Bureau for the purpose of any of the above mentioned proposed actions. In this agreement, "cultural resources" mean data and sites which have archaeological, historical, architectural, or cultural importance and interest.

All cultural resource work carried out on the project will be performed under terms of a valid antiquities act permit. All cultural resource investigators must be acceptable to the Bureau of Land Management.

II. AUTHORITY

This agreement is authorized under the Federal Land Policy and Management Act of 1976. It is in accord with Bureau policies and programs. It does not abrogate nor amend any other agreement between the Bureau and the State.

III. RESPONSIBILITIES AND PROCEDURES

The Bureau will comply with 36 CFR 800 (the Advisory Council Regulations) in identifying and evaluating sites which are listed in or eligible for inclusion in the National Register of Historic Places and determining potential effects and appropriate impact mitigation measures. For mitigating adverse effects on National Register eligible archeological sites, the Advisory Councils Guidelines will be employed.

- A. As part of the planning and environmental analysis required prior to any decisions to authorize rights-of-way for the proposed AWP Project, the Bureau will consult with the State and will research archaeological, historical and ethnographic literature concerning the AWP area. Consultation with local Native American groups to identify areas of cultural significance will be completed (per P.L. 95-341). Class II studies (designed sampling inventories) will be conducted on all public lands that would be affected by the proposal and alternatives. Reports and resource management plans generated at this stage will be reviewed by the State.
- B. Wherever it is determined to be not possible and feasible to avoid sites that contain cultural values, the Bureau will consult with the State and the local Native American community to determine the most satisfactory means of mitigating damage (as required by 36 CFR 800). The Native American Heritage Commission shall be consulted to determine the most satisfactory means of mitigating damage when local Native Americans are not available. Cultural materials will be curated in accordance with current curation standards (per 1906 Antiquities Act) taking into account the desires of the local Native Americans for prehistoric materials.
- C. After completing the planning and environmental analysis process, should the proposed project be implemented, the Bureau will inform project participants of, monitor compliance with, and enforce the following stipulations:
 1. Prior to initiation of ground-disturbing activities, literature searches and intensive survey (BLM Class III) will be undertaken on all areas which would be disturbed. The potential effects of the undertaking on National Register eligible properties will be evaluated (per 36 CFR Part 800).
 2. Whenever possible and feasible, cultural resources will be avoided by construction and related activities. This will be accomplished mainly by rerouting linear facilities such as transmission lines, roads, fences and pipelines, and adjusting locations of other facilities.
 3. A professional archaeologist and a Native American representative (from the appropriate group) will be required to be present when ground disturbing operations are underway in culturally sensitive areas.

4. If previously unidentified cultural resources are encountered during construction they will be preserved through data recovery if there is no other recourse in such a situation. This decision must be approved by the Bureau and the State.

D. The Bureau will provide cultural resources reports, technical reports, and other pertinent materials to the State, local Native Americans and the California Native American Heritage Commission.

E. The State will provide the Bureau with a letter, for use as an exhibit in the AWW EIS to the effect that the procedures herein proposed by the Bureau, if correctly implemented, will satisfy the State's responsibility.

IV. The attached project description (AWW EIS) identifies the specific actions that the Bureau anticipates will be included in the action. The list may be brought up to date, as necessary, without amending this agreement in any way.

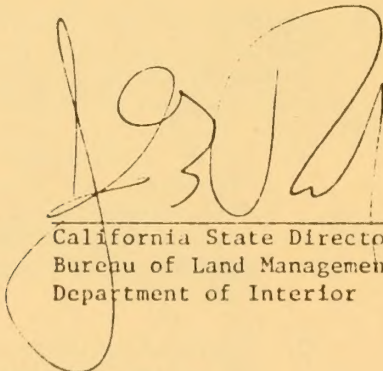
V. IMPLEMENTATION

A. This agreement will become effective on the date of the last signature on this agreement.

B. Either party may request revision or cancellation of this agreement by written notice, not less than 30 days prior to the time when such action is proposed.

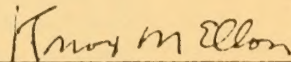
Date:

10/7/80


California State Director
Bureau of Land Management
Department of Interior

Date:

5/6/80


California State Historic
Preservation Officer

Memorandum of Understanding
Between
The Bureau of Land Management
and
The State of Nevada

Allen-Warner Valley Environmental Impact Statement

Cultural Resources

This agreement, effective on the date of last signature, is made by and between the United States of America, acting by and through the Bureau of Land Management, herein referred to as the "Bureau," and the State of Nevada, acting by and through the Division of Historic Preservation and Archeology, herein referred to as the "State."

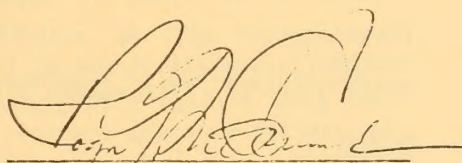
WHEREAS, pursuant to Executive Order 11593 the Bureau is to institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned properties of historical, architectural, archeological, or paleontological in a cultural context significance; and

WHEREAS, pursuant to 36 Code of Federal Regulations Part 60.5 and Nevada Revised Statutes 383.021 the State is to develop effective working relationships with other agencies that participate in the identification and management of cultural resources;

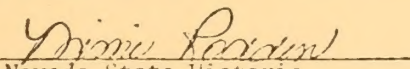
Now, therefore, in consideration of these facts and premises, it is mutually agreed that:

The Bureau and the State will maintain an open dialogue relative to the planning of cultural resource related activities on the Allen-Warner Valley Energy System in order that duplication of effort and the inefficient expenditure of public funds are minimized. All opportunities for the coordination of programs will be fully explored in an expeditious manner.

14 Feb 80
Date


Associate Nevada State Director
Bureau of Land Management
Department of the Interior

6 February 1980
Date


Nevada State Historic
Preservation Officer

CULTURAL RESOURCES
MEMORANDUM OF UNDERSTANDING
ALLEN-WARNER VALLEY ENVIRONMENTAL IMPACT STATEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT
AND
THE STATE OF UTAH

I. PURPOSE

The Bureau of Land Management, hereinafter referred to as the Bureau, is preparing the Environmental Impact Statement under the provisions of the National Environmental Policy Act of 1969. The Bureau has determined that cultural values could be damaged or lost as a result of actions proposed in the AWV EIS. The following kinds of actions are proposed on public lands administered by the Bureau:

- a. Non-Bureau Energy Initiative (NBEI) proposals submitted to the Bureau. These include proposals for rights-of-way and other land uses involving the surface of public lands
- b. Major transportation network proposals in connection with powerplant operation.
- c. Alternatives to the proposals.

The Utah State Historic Preservation Office, hereinafter referred to as the State, is interested in assuring that cultural values in Utah be protected. The Bureau and the State have consulted and agree as to the measures, outlined in this agreement, which should be undertaken to protect these values should authorization be granted to use public lands in Utah administered by the Bureau for the purpose of any of the above mentioned proposed actions. In this agreement, "cultural resources" mean data and sites which have archaeological, historical, architectural, or cultural importance and interest.

Investigators will be qualified to evaluate these "cultural resources." Qualifications of investigators will be submitted to the State Historic Preservation Officer.

II. AUTHORITY

This agreement is authorized under the Federal Land Policy and Management Act of 1976 and the National Historic Preservation Act of 1966. It is in accord with Bureau policies and programs. It

does not abrogate nor amend any other agreement between the Bureau and the State.

III. RESPONSIBILITIES AND PROCEDURES

The Bureau will comply with 36 CFR 800 in identifying sites which are listed in or eligible for inclusion in the National Register of Historic Places.

- A. As part of the planning and environmental analysis required prior to any decision to authorize right-of-way, the Bureau will search for archaeological and historical literature concerning the AWV area.
- B. After completing the planning and environmental analysis process, should the proposed management be implemented, the Bureau will inform project participants of, monitor compliance with, and enforce the following stipulations:
 - 1. Prior to initiation of ground-disturbing activities, literature searches and intensive surveys will be undertaken on all areas which would be disturbed.
 - 2. Wherever possible and feasible, cultural resources will be avoided by construction and related activities. This will be accomplished mainly by rerouting linear facilities such as transmission lines, roads, fences, and pipelines, and adjusting locations of other facilities.
 - 3. A professional archaeologist may be required to be present when ground-disturbing operations are underway.
 - 4. All cultural resources that are encountered during any construction will be salvaged if there is no other recourse in such a situation.
- C. Wherever it is not possible and feasible to avoid sites that contain cultural values, the Bureau will consult with the State to determine the most satisfactory means of mitigating damage, as required by 36 CFR 800.
- D. The Bureau will provide cultural resources reports, technical reports, and other pertinent material to the State.

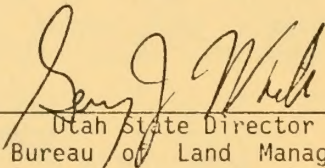
IV. The attached project description identifies the actions that the Bureau anticipates will be included in the description. This may be brought up to date, as necessary, without amending this agreement in any way.

V. IMPLEMENTATION

- A. This agreement will become effective on the date of the last signature on this agreement.
- B. Either party may request revision or cancellation of this agreement by written notice, not less than 30 days prior to the time when such action is proposed.
- C. Any problems resulting from this agreement which cannot be resolved by the Bureau and the State will be referred to the Secretary of the Interior and the Governor of Utah for resolution.

JAN 23 1980

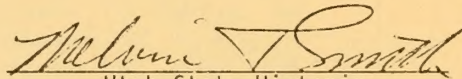
Date



Utah State Director
Bureau of Land Management
Department of the Interior

30 Jan 1980

Date



Utah State Historic
Preservation Officer

ALLEN-WARNER VALLEY ACTION PLAN FOR COMPLIANCE WITH ADVISORY COUNCIL
PROCEDURES FOR PROTECTION OF HISTORIC AND CULTURAL PROPERTIES

The process outlined in 36 CFR, Part 800.4 should be initiated following possible approval of the Allen-Warner Valley Energy System to comply with Section 106 of the National Historic Preservation Act and Section 1(3) of Executive Order 11593. These compliance procedures are outlined in table 1.

TABLE 1

Allen-Warner Valley Action Plan for Compliance with Advisory Council
Procedures for Protection of Historic and Cultural Resources

Required Actions Necessary for Compliance	Agencies Required to Complete Action	Tentative Time Requirements
1. Identify properties included on the National Register of Historic Places that are located within the Allen-Warner Valley Energy System's potential area of environmental impact.	Bureau of Land Management Cedar City District Office	Completed
2. Identify properties eligible for inclusion in the National Register, and consultation with the appropriate State historic preservation officer to apply the <u>National Register Criteria</u> (36 CFR, Part 800.10).	Cedar City District Office, Utah SHPO, Arizona SHPO, Nevada SHPO, California SHPO	30 days
3. Apply the <u>Criteria of Effect</u> (36 CFR, Part 800.8) to determine whether the action will have an effect on properties included in or eligible for inclusion in the National Register. Apply criteria in consultation with appropriate State historic preservation officer. If no effect is determined, the project may proceed.	Bureau of Land Management Utah SHPO, Arizona SHPO, Nevada SHPO, California SHPO	30 days
4. Apply <u>Criteria of Adverse Effect</u> (36 CFR, Part 800.9) to determine if the action will have an adverse effect on properties included in or eligible for inclusion in the National Register. a. Upon finding no adverse effect, BLM shall forward adequate documentation and views of appropriate SHPO to Executive Director of Advisory Council for review. If the Executive Director does not express objections within 45 days, the agency may proceed with project. b. Upon finding an adverse impact or upon notification of the Executive Director, the following actions are required:	Bureau of Land Management, Executive Director of the Advisory Council on Historic Preservation, Utah SHPO, Arizona SHPO, Nevada SHPO, California SHPO	55 days

(continued)

TABLE 1 (continued)

Required Actions Necessary for Compliance	Agencies Required to Complete Action	Tentative Time Requirements
1. Request comments of Advisory Council 2. Notify SHPO of request 3. Prepare a preliminary case report 4. Proceed with consultation process (36 CFR, Part 800.5)	Bureau of Land Management Utah SHPO, Arizona SHPO, Nevada SHPO, California SHPO Executive Director of Council	55 days
5. Consultation process (36 CFR, Part 800.5)		
a. Upon request for Advisory Council comments, the Executive Director will initiate the consultation process.		
b. Conduct onsite inspection.		
c. Conduct a public information meeting.		
d. After review of the case, and subsequent to onsite inspection and public meeting, the Executive Director will determine whether there is a feasible alternative to avoid or mitigate any adverse effect.		
e. If BLM, SHPOs, and Executive Director unanimously agree on an alternative to avoid any adverse impact, they shall execute a Memorandum of Agreement acknowledging avoidance of adverse impact. Document is forwarded to chairman for review (Section 800.6a).		
f. If parties cannot agree on an alternative to avoid any adverse impact, the agencies will determine if there is an alternative to mitigate the adverse impact. Upon agreement on such an alternative, the parties shall execute a Memorandum of Agreement acknowledging mitigation of adverse impact. Document is forwarded to chairman for review (Section 800.6a).		

(continued)

TABLE 1 (concluded)

Required Actions Necessary for Compliance	Agencies Required to Complete Action	Tentative Time Requirements
g. Upon failure of parties to find and agree upon an alternative to avoid or mitigate adverse impacts, the Executive Director shall schedule the undertaking for consideration at the next council meeting. Agency official shall delay processing of the undertaking until comments are received from the council.	6. Advisory Council procedures. For details concerning council procedures (see 36 CFR, Part 800.6).	Unknown

APPENDIX 10

Visual Resource Management System

To evaluate the scenic resource, BLM has developed the Visual Resource Management (VRM) system (BLM Manual 8400). Classification involves evaluation of scenic quality, visual sensitivity, and distance zones. These three factors determine the visual resource management class for an area. There are five visual management classes an area may fall into, and for each class there is a different management objective defined in terms of visual tolerance to surface disturbance. Management objectives for each class are described as follows:

Class I

This class provides primarily for natural ecological changes only. It is applied to wilderness areas, some natural areas, and other similar situations where management activities are to be restricted.

Class II

Changes in any of the basic landscape elements (form, line, color, or texture) should not be evident in the characteristic landscape.

Class III

Changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. However, the changes should remain subordinate to the visual strength of the existing character.

Class IV

Contrasts may attract attention and be a dominant feature of the landscape in terms of scale, but the change should repeat the basic elements inherent in the characteristic landscape.

Class V

Change is needed. This class applies to areas where the naturalistic character has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape.

APPENDIX 11

Baseline Socioeconomic Statistics and Projections

The tables in this appendix present 1980 baseline socioeconomic and demographic statistics for Kane and Washington Counties of Utah and Clark County of Nevada. Projections of anticipated socioeconomic trends are also presented for 1980 through 2000.

<u>Table Number</u>	<u>Title</u>
1	Baseline Population Projections, 1980-2000
2	Baseline Employment Projections, 1980-2000
3	Baseline Earning Projections, 1980-2000
4	Baseline Projections For Police Service Requirements, Police Officers
5	Baseline Projections for Fire Service Requirements, Pumping Capacity
6	Baseline Projections for Water Supply Requirements
7	Baseline Projections for Sewage Treatment Requirements
8	Baseline Projections for School District Enrollment and Teachers
9	Baseline Projections for Health Care Facilities

TABLE 1
Baseline Population Projections, 1980-2000

County/City	1970 Census	1980	1985	1990	1995	2000	Percent Change 1970-1980	Annual Compound Growth Rate		Percent Change 1980-2000	Annual Compound Growth Rate	
								1970-1980	1980-2000		1970-1980	1980-2000
Kane County	2,421	^a 3,929	5,040	5,938	6,662	7,688	62			95.7	5.0	3.4
Alton	62	75	50	59	67	77	21			2.7	1.9	0.1
Glendale	200	235	312	327	320	316	18			34.5	1.6	1.5
Kanab	1,381	2,095	2,908	3,426	3,844	4,436	51			111.7	4.2	3.8
Orderville	399	428	512	603	603	611	7			42.8	0.7	1.8
Remainder of County	.....	1,096	1,293	1,523	1,828	2,248	...			105.1	....	3.7
Washington County	13,669	^a 24,901	30,578	35,012	38,794	43,177	69			73.4	5.4	2.8
Hurricane	1,408	2,379	2,565	2,668	2,657	2,625	69			10.3	5.4	0.5
Invins	137	594	599	739	892	1,071	334			95.1	15.8	3.4
LaVerkin	463	1,167	1,272	1,485	1,676	1,900	152			62.8	9.7	2.5
Leeds	151	217	269	308	341	380	26			75.1	2.4	2.8
St. George	7,097	11,111	15,167	17,646	19,859	22,443	57			102.0	4.6	3.6
Santa Clara	271	1,063	1,040	1,218	1,377	1,563	292			47.0	14.6	1.9
Toquerville	185	282	266	305	338	376	52			33.3	4.3	1.4
Washington	750	2,218	2,413	2,612	3,061	3,584	196			61.6	11.5	2.4
Remainder of County	.....	5,870	6,987	8,031	8,593	9,235	...			57.3	....	2.3
Clark County	273,288	^b 474,485	578,614	682,743	786,872	891,000	74			105.1	5.7	3.7

Source: Baseline population projections for Kane and Washington Counties have been supplied through the Office of State Planning Coordinator (State of Utah). These projected growth rates based on historic trends for the areas have been applied to preliminary 1980 Census figures as a base year. The above county level growth projections have been distributed among individual communities on the basis of each community's historical proportion of countywide population. Trends for these proportions have been developed with data spanning the past 40 years up through 1980. Baseline projections for the Las Vegas Valley area were obtained from Centaur Associates, Inc., Socioeconomics, 1980

^aPreliminary Census figures for 1980.

^bEstimate from Centaur Associates, Inc., Socioeconomics, 1980.

TABLE 2

Baseline Employment Projections, 1980-2000

	1980			1985			1990			1995			2000		
	Number of Jobs	Percent of Total		Number of Jobs	Percent of Total		Number of Jobs	Percent of Total		Number of Jobs	Percent of Total		Number of Jobs	Percent of Total	
Kane County															
Agriculture	168	13.8		190	11.7		197	10.2		196	8.9		203	7.9	
Mining	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Construction	75	6.2		101	6.2		116	6.0		132	6.0		155	6.0	
Manufacturing	84	6.9		123	7.6		162	8.4		196	8.9		242	9.4	
T.C.U.	46	3.8		55	3.4		70	3.6		75	3.4		88	3.4	
Trade	281	23.1		370	22.8		442	22.9		501	22.8		586	22.7	
Fire	28	2.3		45	2.8		46	2.4		57	2.6		67	2.6	
Services	281	23.1		391	24.1		466	24.1		540	24.6		641	24.9	
Government	253	20.8		348	21.4		431	22.3		501	22.8		598	23.2	
Total	1,216	100.0		1,624	100.0		1,933	100.0		2,197	100.0		2,575	100.0	
Washington County															
Agriculture	568	6.7		582	5.8		579	5.1		560	4.5		561	4.1	
Mining	17	0.2		20	0.2		11	0.1		12	0.1		14	0.1	
Construction	551	6.5		642	6.4		715	6.3		772	62.0		835	6.1	
Manufacturing	729	8.6		973	9.7		1,158	10.2		1,358	10.9		1,560	11.4	
T.C.U.	314	3.7		361	3.6		409	3.6		436	3.5		479	3.5	
Trade	2,680	31.6		3,089	30.8		3,406	30.0		3,662	29.4		3,968	29.0	
Fire	390	4.6		481	4.8		556	4.9		635	5.1		712	5.2	
Services	1,371	16.2		1,695	16.9		1,987	17.5		2,242	18.0		2,531	18.5	
Government	1,866	22.0		2,176	21.7		2,520	22.2		2,765	22.2		3,038	22.2	
Total	8,482	100.0		10,028	100.0		11,350	100.0		12,455	100.0		13,682	100.0	
Clark County															
Agriculture	695	0.3		729	0.3		748	0.2		777	0.2		804	0.2	
Mining	201	0.1		235	0.1		264	0.1		296	0.1		328	0.1	
Construction	8,976	4.4		11,250	4.3		13,690	4.2		16,019	4.2		18,376	4.2	
Manufacturing	7,585	3.7		10,270	3.9		12,930	4.0		15,607	4.1		18,279	4.1	
T.C.U.	12,110	6.0		15,310	5.9		18,560	5.8		21,777	5.7		25,002	5.7	
Trade	38,630	19.1		51,070	19.6		63,670	19.7		76,163	19.9		88,683	20.0	
Fire	7,559	3.7		10,150	3.9		13,110	4.1		15,824	4.1		18,660	4.2	
Services	92,740	45.8		120,100	46.0		148,600	46.0		176,340	46.1		204,270	46.2	
Government	33,950	16.8		41,690	16.0		51,200	15.9		59,530	15.6		68,155	15.4	
Total	202,446	100.0		260,804	100.0		322,772	100.0		382,333	100.0		442,497	100.0	

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

TABLE 3

Baseline Earnings Projections, 1980-2000 (in millions of 1977 dollars)

	1980			1985			1990			1995			2000		
	Income	Percent of Total	Percent of Total	Income	Percent of Total	Percent of Total	Income	Percent of Total	Percent of Total	Income	Percent of Total	Percent of Total	Income	Percent of Total	Percent of Total
Kane County															
Agriculture	1.07	10.0		1.34	8.5		1.53	7.4		1.67	6.4		1.93	5.7	
Mining	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Construction	1.71	15.9		2.43	15.4		3.11	15.0		3.91	15.0		5.0	148.0	
Manufacturing	0.53	4.9		0.85	5.4		1.24	6.0		1.64	6.3		2.23	6.6	
T.C.U.	0.53	4.9		0.69	4.4		0.95	4.6		1.15	4.4		1.45	4.3	
Trade	1.89	17.6		2.73	17.3		3.63	17.5		4.54	17.4		5.84	17.3	
Fire	0.25	2.3		0.43	2.7		0.50	2.4		0.65	2.5		0.84	2.5	
Services	2.77	25.8		4.27	27.0		5.60	27.0		7.17	27.5		9.39	27.8	
Government	2.01	18.7		3.04	19.0		4.17	20.1		5.35	20.5		7.06	20.9	
Total	10.74	100.0		15.81	100.0		20.73	100.0		26.08	100.0		33.77	100.0	
Washington County															
Agriculture	13.94	15.2		15.88	13.4		17.49	11.9		18.25	10.6		20.48	9.6	
Mining	0.28	0.3		0.24	0.2		0.29	0.2		0.35	0.2		0.43	0.2	
Construction	7.61	8.3		9.72	8.2		11.90	8.1		14.33	8.1		17.07	8.0	
Manufacturing	8.25	9.0		12.21	10.3		16.02	10.9		20.69	11.7		26.24	12.3	
T.C.U.	5.96	6.5		7.71	6.5		9.41	6.4		11.32	6.4		13.65	6.4	
Trade	21.10	23.0		26.91	22.7		32.77	22.3		38.91	22.0		46.30	21.7	
Fire	4.04	4.4		5.45	4.6		7.05	4.8		8.84	5.0		10.88	5.1	
Services	13.94	15.2		18.97	16.0		24.54	16.7		30.60	17.3		37.98	17.8	
Government	16.51	18.0		21.34	18.0		27.19	18.5		32.90	18.6		40.11	18.8	
Total	91.72	100.0		118.54	100.0		146.97	100.0		176.88	100.0		231.35	100.0	
Clark County															
Agriculture	16.37	0.6		18.96	0.5		21.48	0.4		24.15	0.3		28.14	0.3	
Mining	3.22	0.1		4.16	0.1		5.16	0.1		6.38	0.1		7.81	0.1	
Construction	182.13	6.6		252.03	6.5		338.62	6.4		437.46	6.3		554.61	6.3	
Manufacturing	125.43	4.6		187.51	4.8		260.64	4.9		347.35	5.0		449.17	5.1	
T.C.U.	234.22	8.5		326.93	8.4		441.26	8.3		571.65	8.2		724.61	8.2	
Trade	412.88	15.1		602.63	15.5		829.49	15.6		1,095.53	15.8		1,408.37	15.9	
Fire	107.31	3.9		159.09	4.1		226.84	4.3		302.35	4.4		392.37	4.4	
Services	1,246.70	45.5		1,782.52	45.8		2,435.11	45.8		3,190.34	45.9		4,080.29	46.0	
Government	411.44	15.0		557.81	14.3		756.38	14.2		970.99	14.0		1,227.34	13.8	
Total	2,739.31	100.0		3,891.64	100.0		5,314.99	100.0		6,946.20	100.0		8,872.71	100.0	

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

TABLE 4

Baseline Police Service Requirement Projections
1980-2000 (Police Officers)

Current Estimated Full Time Equivalent Officers (1978)		Projected Needs				
		1980	1985	1990	1995	2000
Kane County						
Alton	N/A	a	a	a	a	a
Glendale	N/A	a	a	a	a	a
Kanab	3.0	4.5	6.0	7.0	8.0	9.0
Orderville	N/A	b	b	b	b	b
Washington County						
Hurricane	^c 3.0	5.0	5.5	5.5	5.5	5.5
Ivins	1.0	1.5	1.5	1.5	2.0	2.0
LaVerkin	PT	2.5	2.5	3.0	3.5	4.0
Leeds	1.0	b	b	b	b	b
St. George	20.0	19.0	26.0	30.0	34.0	38.5
Santa Clara	N/A	2.5	2.5	2.5	3.0	3.5
Toquerville	N/A	1.0	1.0	1.0	1.0	1.0
Washington	^d 4.5	4.5	5.0	5.5	6.5	7.5
Clark County						
Las Vegas	^e 367.0	807.0	984.0	1,161.0	1,338.0	1,515.0

Source: BLM, alculated from Centaur Associates, Inc., Socioeconomics, 1980

^aOne officer working half time or less.

^bOne officer working more than half time.

^cDuring the first half of 1978, the town also employed two part-time officers.

^dA fourth full-time officer is to be hired in January 1980.

^dThis figure is based on the assumption that the city's three part-time officers were employed half time. In July 1979, the city disbanded its police department and contracted with the Washington County Sheriff's Department to have two deputies stationed in the city.

^eThis figure includes Las Vegas - 289 officers, North Las Vegas - 41 officers, and Henderson - 37 officers.

NOTE: For the four towns of over 500 persons (those needing more than one full-time officer), projected needs are rounded. Fractions less than 0.5 are rounded up to 0.5 and fractions greater than 0.5 are rounded up to 1.0. For towns under 10,000 population, projections are based on a standard of two full-time equivalent officers per 1,000 persons. For cities over 10,000 the standard for projections is 1.7 officers per 1,000 population.

N/A - Not applicable

pt - One part-time officer

TABLE 5

Baseline Projections for Fire Service Requirements, Pumping Capacity in Gallons per Minute Pumped

Community	Available Pumping Capacity (gmp)	1980	1985	1990	1995	2000
	1978					
Kane County						
Alton ^a	NA	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Glendale ^b	N/A	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Kanab	2,500	1,750-2,000	1,750-2,000	1,750-2,000	2,000-2,250	2,000-2,250
Orderville ^b	150	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Washington County						
Hurricane ^c	2,500	1,500-1,750	1,500-1,750	1,500-1,750	1,500-1,750	1,500-1,750
Ivins	500	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
LaVerkin	N/A	500-1,000	1,000-1,250	1,000-1,250	1,000-1,250	1,250-1,500
Leeds	^e 250	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
St. George ^f	4,950	3,000-3,500	3,000-3,500	3,500-4,000	4,000-4,500	4,500-5,000
Santa Clara ^f	N/A	500-1,000	500-1,000	500-1,000	1,000-1,250	1,000-1,250
Toquerville ^g	N/A	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Washington	^h 1,250	1,500-1,750	1,500-1,750	1,500-1,750	1,750-2,000	1,750-2,000
Clark County						
Las Vegas Valley ⁱ						

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aA surplus forestry tanker with an unknown pumping capacity was acquired by the town in 1978. As of October 1979 a station was being built to house the vehicle but potential volunteers had not yet received required training.

^bThe Long Valley Fire Department, located in Orderville, provides for protection of Orderville, Glendale, and Mt. Carmel.

^cIn 1978 the service area of the Hurricane department included LaVerkin, Toquerville, and Virgin. In October 1979, a department was established in LaVerkin which has relieved Hurricane's department of responsibility for those three towns.

^dDelivery of an additional vehicle with 1,000 gmp capacity is expected in October 1979.

^eTwo additional vehicles to be delivered in October 1979 will raise total pumping capacity to 1,000 gmp.

^fThe St. George department also provides fire protection to Santa Clara.

^gLaVerkin, previously covered by Hurricane's department, established a volunteer department in October 1979. At that time, the department had borrowed a 750 gmp pump while awaiting delivery of the 1,250 gmp vehicle, expected in November, 1979. The department will provide fire protection for Toquerville and Virgin.

^hAn additional 1,000 gmp capacity vehicle was received in July 1979, raising total pumping capacity to 2,250 gmp.

ⁱFire protection in Las Vegas Valley is provided by four departments which together had 685 paid fire-fighters and pumping capacity of 51,800 gmp in 1978. The service area of these departments is all of Clark County except Boulder City. Under the baseline, future population can be expected to increase steadily from 423,020 in 1978, to 1,285,700 in 2020. In the baseline scenario, additional fire flow needs can be expected to be felt throughout the Las Vegas Valley. However, the highest population increases are expected in Henderson and the areas for which the Clark County Department is responsible. Henderson will need up to twice its present pumping capacity, a total of 11,000 gmp by 2020. The needs of the Clark County Department cannot be evaluated due to the mixture of the urban and rural areas under its protection. North Las Vegas will have to increase its 1978 pumping capacity by some 40 percent by 2020.

NOTE: gmp = gallons per minute pumped

N/A = not applicable (i.e., no fire department)

NA = not available

TABLE 6

Baseline Water Needs Projections

	Estimated Supply 1980 ^a	Projected Water Needs (Million Gallons/Day) ^b				
		1980	1985	1990	1995	2000
Kane County						
Alton	0.161	0.034	0.023	0.027	0.030	0.035
Glendale	0.250	0.106	0.140	0.147	0.144	0.142
Kanab	1.750	0.943	1.309	1.542	^c 1.730	1.996
Orderville	0.426	0.193	0.230	0.271	0.271	0.275
Washington County						
Hurricane	1.944	1.071	1.154	1.201	1.196	1.181
Ivins	0.545	0.267	0.270	0.333	0.401	0.482
LaVerkin	1.293	0.525	0.572	0.668	0.754	0.855
Leeds	0.233	0.098	0.121	0.139	0.153	0.171
St. George ^d	14.057	6.181	7.368	8.784	10.473	12.485
Santa Clara	0.905	0.478	0.468	0.548	0.620	0.703
Toquerville ^e	0.323	0.128	0.120	0.137	0.152	0.169
Washington	1.800	0.990	1,086	1.175	1.377	1.613
Clark County						
Las Vegas Valley ^f						

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aEstimated from Centaur Associates, Inc., Socioeconomics, 1980.

^bProjected water needs based upon a standard of 450 gallons per person per day (Chalmers and Anderson) which is roughly equivalent to 1,600 gallons per hookup with an average of 3.5 persons per household.

^cAt projected population growth rates, Kanab's existing water supplies would become marginal by around 1995.

^dSt. George also supplies water to Bloomington and Bloomington Hills, currently unincorporated portions of the county. Population projections for these areas have been factored into the above water needs figures for St. George.

^ePotential capacity with planned improvements. Existing (1979) capacity of 0.162 MGD would be exceeded before the year 2000.

^fThe primary source of water for the Las Vegas Valley is the Las Vegas Valley Water District, which presently can deliver 200 mgd. Its treatment facility will be expanded to a 400 mgd capacity by mid-1982. Under the baseline, the valley's population is expected to increase steadily from 414,977 in 1978 to 1,258,457 in 2020. By 1980 the area's peak demand should reach 204.8 mgd, or 102-percent capacity. Upon completion of planned expansion in mid-1982, the shortfall will be eliminated through 2000, when peak demand will be 385.6 mgd.

TABLE 7

Baseline Sewage Treatment Needs Projections, 1980-2000

	Estimated Capacity 1980	Projected Needs (MGD at 168 GPCD)				
		1980	1985	1990	1995	2000
Kane County						
Alton	N/A	0.013	0.008	0.010	0.011	0.013
Glendale/ Orderville	0.081	0.111	0.138	0.156	0.155	0.156
Kanab	0.300	0.352	0.489	0.576	0.616	0.715
Washington County						
Hurricane/ LaVerkin/ Toquerville	1.226	0.643	0.689	0.749	0.785	0.823
Ivins	N/A	0.100	0.101	0.124	0.150	0.180
Leeds	N/A	0.036	0.045	0.052	0.057	0.064
St. George/ Santa Clara	3.000	2.045	2.723	3.169	3.568	4.033
Washington	0.12	0.373	0.405	0.439	0.514	0.602
Clark County						
Las Vegas Valley ^a						

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aIn 1978, Las Vegas Valley had three sewage treatment facilities with a combined capacity of 64.5 mgd. By mid-1980, the combined capacity will be 73.5 mgd but the valley's 1980 population will have reached 455,143 and have a total peak flow of 76.5 mgd. Under the baseline, population growth will be steady. If this population would all be served by a centralized sewage system, there would be a need for 211.4 mgd. Henderson will be severely affected, reaching 23.1 mgd by 2020, 367 percent of the projected capacity of the facility to be built in 1982. Also by 2020, Las Vegas and North Las Vegas will be at 147 percent capacity and unincorporated Las Vegas Valley, if entirely on the sewer system, will be at 333 percent capacity.

NOTE: MGD = Million gallons per day
GPCD = Gallons per capita-day

TABLE 8

Baseline School District Enrollment
and Staffing Needs Projections 1980-2000

	1980 Estimates	1985	1990	1995	2000
Kane County					
Enrollment	^a 933	1,260	1,485	1,666	1,922
Staffing	^b 40 (54)	50	59	67	77
Washington County					
Enrollment	^c 6,300	7,981	9,138	10,125	11,269
Staffing	^b 252 ^d (260)	319	366	405	451
Clark County					
Enrollment	94,495	115,232	135,970	156,708	177,445
Staffing	4,534	5,524	6,524	7,520	8,515

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aFigure represents current (1980) enrollment figures for Kane County schools.

^bFigure represents the level of staffing necessary to maintain the maximum student/teacher ratio of 25:1. Figure in parentheses represents current staffing of certified teachers and principals, but does not include aides, etc.

^cFigure represents current (1980) enrollment estimates for Washington County schools.

^dFrom Centaur Associates, Inc., 1980.

TABLE 9

Baseline Projections for Health Care Facilities

Facility/Type	1980	1985	1990	1995	2000
Kane County					
Hospital	6	7	9	10	11
Nursing Home	23	26	29	32	35
Washington County					
Hospital	63	77	88	98	109
Nursing Home	223	272	309	342	379
Clark County					
Hospital	1,252	1,528	1,803	2,087	2,352
Nursing Home	978	1,190	1,403	1,615	1,827

Source: BLM, calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Projected needs are based on the following standards:

- Hospital Beds:
- 1) $\frac{\text{Patient days per year}}{\text{Current population}} = \text{Current use rate}$
 - 2) $\frac{\text{Current use rate} \times \text{projected population}}{365} = \text{Average bed need per day}$
 - 3) $\frac{\text{Average bed need per day}}{.80} = \text{Bed need for projected year}$
- Nursing Home Beds:
- 1) $\frac{\text{Patient days per year}}{\text{Current population}} = \text{Current use rate}$
 - 2) $\frac{\text{Current use rate} \times \text{projected population}}{365} = \text{Average bed need per day}$
 - 3) $\frac{\text{Average bed need per day}}{.90} + 10 = \text{Bed need for projected year}$

APPENDIX 12

Photographic Simulations of Visibility Impacts - Technical Specifications

PHOTOGRAPHIC SIMULATIONS OF VISIBILITY IMPACTS - TECHNICAL SPECIFICATIONS

The information presented in this Appendix has been taken from "Description of Warner Valley-Zion Plume Blight Simulations" prepared by Williams, Cooper and Wecksung (1980).

INTRODUCTION

The Warner Valley powerplant site lies 20 miles southwest of Zion National Park and 13 miles southeast of St. George, Utah. The capacity of the plant will be 500 MW. Under stable conditions, with wind from the southwest at low wind speed, it is possible that the smoke plume may be visible from some point in the park. A plume visible from the park might impair air quality-related values with possible ramifications for siting and control options for the Warner Valley powerplant.

Visibility impacts are a complicated function of the observer's position, the background against which the plume may be seen, meteorology, and emission characteristics. This appendix describes the application of the simulated photograph technique (using the LASL visibility model) to the case of Warner Valley powerplant impacts on Zion National Park.

GENERAL OBSERVATIONS ON PLUME BLIGHT ASSESSMENT

Plume blight assessment has two principal components: (1) definition of the magnitude of the effects during important circumstances, and (2) determination of the frequency of the conditions which lead to significant effects. One important method for defining the magnitude of the effects is through the use of the simulated photograph technique. In this technique, there are four steps. First, a photograph is taken of the scene that may be impacted. Second, the dispersion of pollutants from the source is modeled, and the light-absorption and light-scattering parameters defined. Third, the alterations in brightness of the scene produced by the pollutants are calculated. Finally, a new picture is constructed.

The model has been previously used to simulate an actual plume from a southwestern powerplant. Figure 1 is a photograph of the TV screen upon which an actual picture of a smoke plume has been displayed. Figure 2 is the model simulation for the same case. In comparison, the two photographs suffer somewhat from the fact that the original slide was taken with an obsolete film for which film characteristics are not available. Consequently, there has been no correction for aberrations introduced by the film in the original picture.

The powerplant plume is most likely to cause plume blight during thermally stable, light wind conditions, with a small angle between the sun and

the plume axis from the vantage point of the observer. In the dry desert areas of the southwest, stable conditions with light winds are most apt to occur in the fall during cooler times of the day.

The frequency of any particular set of conditions at most remote sites in the southwest is very difficult to determine. This is particularly true for stable flow at the effective plume height for a large coal-fired power-plant. During stable conditions, wind directions and wind speeds vary greatly with height so that surface data or data collected by a 100-meter tower may not be representative of conditions at a typical plume height of 300 to 500 meters. In the morning hours when mixing heights are changing rapidly, meteorological measurements made near the surface will not be representative of conditions at higher altitudes.

A further complication is that upper air data is collected at only 12-hour intervals at locations spaced widely apart, and it may not be representative over the varied terrain and distances between stations in the southwest. These difficulties make it virtually impossible, without a great deal of further work, to assign frequencies of occurrence of specific conditions at Zion National Park.

Some data collected in other locations in the southwest provide some information on frequencies of wind speed and stability. Near Capitol Reef National Park, two-thirds of the mornings exhibited stable conditions according to temperature distributions measured 1,000 to 1,300 feet above ground level. ¹ Approximately 50 percent of the morning winds, measured at a height of 1,000 feet above the ground near Lake Powell, exhibited speeds less than 2.5 meters per second (m/s). ² On this basis the combination of 2 m/s winds and stable conditions is not unlikely. The winds and stabilities assumed would be expected with a high pressure system to the southeast.

WARNER VALLEY PLUME BLIGHT SIMULATIONS

Two slides of scenes likely to be affected by the Warner Valley power-plant were used. The two scenes, Observation Point and Watchman Point, are near park headquarters above the Virgin River. Observation Point is quite elevated with respect to the valley floor and was selected to illustrate pollution as seen against local terrain features. Watchman Point is closer to the valley floor and allows one to visualize the plume against both the horizon and local terrain features. Photographs of each of the scenes were taken to provide base slides for the computer-simulated photograph technique.

The photograph for Observation Point was taken at 9:00 a.m., MST on June 13, 1979. The photograph for Watchman Point was taken at 9:53 a.m., MST, on June 17, 1979. The estimated visual range for the 2 days was 125 kilometers. These visual ranges were estimated using the distance to skyline features and the contrast between those features and the sky. It should be noted that the visual range under Rayleigh conditions (light scattering by gaseous molecules in air) is three times the visual range represented by the two photographs. Thus the visibility was significantly poorer on those 2 days than is possible without any atmospheric pollutants.



PHOTOGRAPH OF AN ACTUAL PLUME FROM A SOUTHWESTERN
POWERPLANT AS DISPLAYED ON THE TV SCREEN

FIGURE 1



MODELED PLUME FROM A POWERPLANT DURING
CONDITIONS APPROPRIATE TO FIGURE 1

FIGURE 2

The prevailing meteorological conditions on the days the photographs were taken are likely to be different from those assumed in the visibility simulation. Although it is desirable to assess the effects these differences would have on the final results, this assessment is impossible in this case because the background atmospheric particulate matter is unknown. Despite these unknown factors, the sun angle, which is appropriately simulated, can be expected to have a more significant effect on plume blight than the use of different base photographs.

The photographs were taken during the late spring, in the morning, with a sun angle approximating that which exists in the fall. In the scenes identified, the position of an observer with respect to the plume in early morning would give relatively large scattering angles because the sun would be east to east-southeast of the observer while the plume would be south to southwest of the observer. This is important because small angle scattering has a much greater effect on plume visibility impairment than large angle scattering (for example, McClatchey reports normalized scattering functions of approximately 2, 0.3, 0.07, and 0.03 for the scattering angles of 10° , 30° , 60° , and 90° , respectively^{3/}). Thus, for small scattering angles the effects of atmospheric pollutants will be greatly enhanced. However, with the particulate controls used for the Warner Valley powerplant and the scattering angles between the observation points and plume axis, the role of atmospheric pollutants on visibility impairment is very limited in this case. Further, small changes in the scattering angle between early summer and fall are not likely to be important during morning hours. Thus, for the above-mentioned reasons, the base photographs are expected to provide a representative simulation.

Intervening terrain could play a very important role in the appearance of the plume. If the plume height upwind of the terrain is less than the height of the terrain, the terrain is apt to provide additional mixing that would effect a much more rapid dispersion. One such situation was encountered in the Lake Powell studies.^{4/} On this occasion a well-defined plume, visually evident for 55 kilometers, interacted with high terrain and was no longer detectable visually or with instruments. In the Warner Valley analysis, it is assumed that the powerplant plume does not impact the intervening terrain. This is an appropriate assumption when the air upwind of the terrain stagnates causing higher plume rise, so that the plume passes over the intervening terrain. Recent tracer studies conducted in the vicinity of the proposed powerplant may provide additional data or lead to additional analyses that will assist with determining the effect of intervening terrain and possibly the frequency of occurrence of meteorological conditions.

Slides corresponding to the Warner Valley scenes were digitized to provide the clean background for the simulated pictures. In addition, background particulates were estimated, and the background radiative transfer was calculated for the sun angles corresponding to the time the pictures were taken. Once these background conditions were calculated, plume simulations were then possible. Two cases, one for each original picture, were simulated.

In each instance converted aerosols were assumed to be quite small (0.08μ mass median diameter [MMD]). This value is based on two sets of measurements in the southwest and on model estimates. The first set of measurements are from unpublished work by Chuan and were taken near the Four

Corners powerplant. In Chuan's work, the mass median diameter was found to drop from high values near the plant to values of approximately 0.1μ at larger distances where converted aerosols dominated. Detailed measurements showed that the near-stack distribution had been altered by the addition of relatively large amounts of particles less than 0.1μ in diameter. These findings are also consistent with those of Pueschel and Van Valin who found that converted aerosols were less than 0.1μ and provided little additional scattering.^{5/} Furthermore, work by Hegg and Hobbs reported a ratio of 1 to $4 \times 10^5 \mu^3$ for nucleus-formation-to-volume-formation of secondary aerosols which would indicate that much of the additional particle volume is going directly to condensation nuclei.^{6/} Under these circumstances relatively small particles (0.15μ MMD),^{7/} are predicted by models which calculate particle coagulation and formation.

In the Observation Point case, winds are presumed to carry the plume from the plant into the park and out of view at the observer's left. In the Watchman Point case, the winds carry the plume toward the observer. Figure 3 depicts the geometry for these two cases.

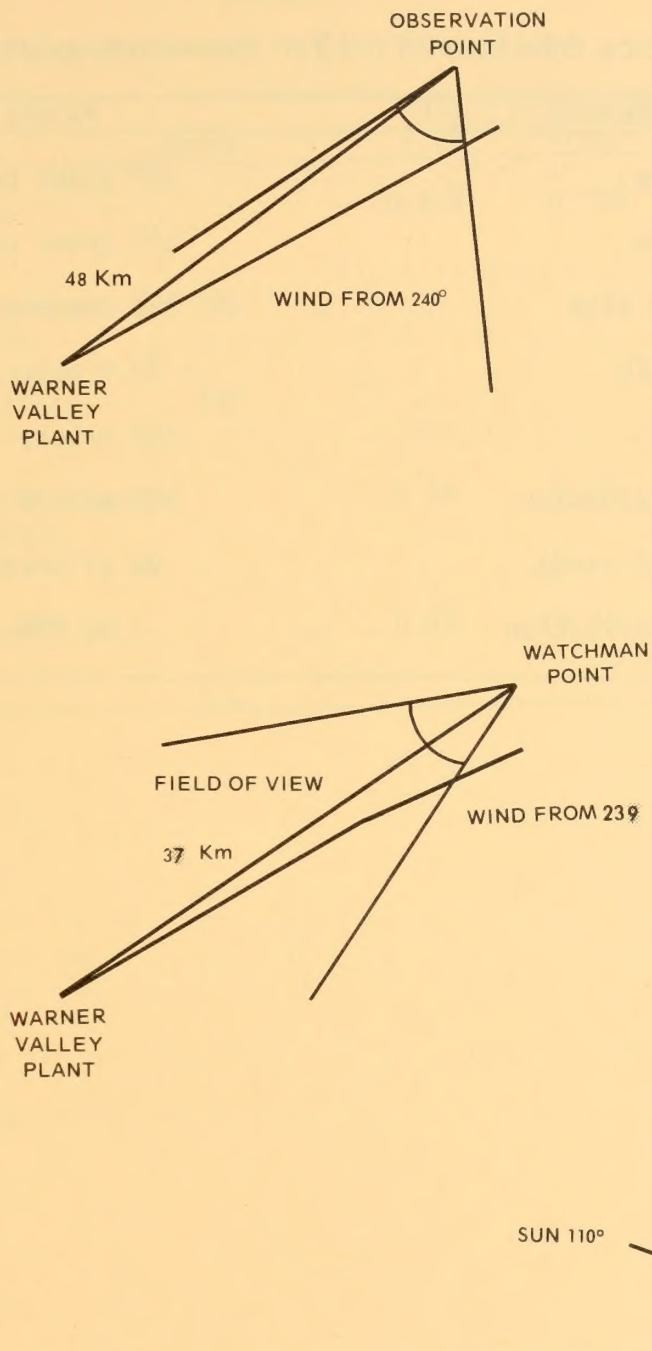
In each case the wind speed chosen was 2 meters per second and the Tennessee Valley Authority (TVA) stable conditions were assumed. Relevant emission and source parameters are summarized in table 1 for a 500-MW powerplant. An artificially large stack radius of 8 meters was used to permit sufficient plume rise above nearby terrain obstacles. The procedure simulates the effects of lighter winds below the height of the terrain and permits plume transport and dispersion without the influence of intervening terrain.

In each case the wind speed chosen was 2 meters per second, TVA stable conditions. Relevant emission and source parameters are summarized in table 1.

The modeling techniques employed for dispersion, radiative transfer, and simulated photograph construction are described elsewhere.^{7/ 8/ 9/}

The conversion half-lives and light scattering properties of the pollutants are reported in table 2.

Table 3 reports plume transmission (TR) and additional scattering (Bsky') for each color at the point of minimal transmission. The light scattering values (Bsky') are normalized to the light intensities at the horizon nearest the center of the picture.



SOURCE: NATIONAL PARK SERVICE

FIGURE 3

VIEWING GEOMETRY FOR OBSERVATION POINT AND WATCHMAN POINT VISUAL SIMULATIONS

TABLE 1

Source Characteristics for the Warner Valley Plant

Model Input Parameters	Values
NO _x emission rate	504 grams per second
SO ₂ emission rate	108 grams per second
Fly ash emission rate	350 degrees Kelvin
Stack gas velocity	20.9 meters per second
Stack height	152 meters
Base of stack evaluation	989 meters above sea level
Background visual range	96 kilometers
Fly ash size distribution	1.0μ MMD

TABLE 2

Parameters used in Zion Simulations

	Hours	Square Meters Per Gram		
		Blue	Green	Red
Fly Ash scattering to mass ratio		0.687	0.705	0.719
Nitrogen oxide to Nitrate Conversion half-life	190			
Sulfur Dioxide to Sulfate Conversion half-life	190			
Secondary aerosol scattering to mass ratio without suffix N		0.54	0.24	0.14
Nitrogen dioxide absorption to mass ratio		0.62	0.30	0.02

TABLE 3

Plume Transmissions and Light Scattering for the
Observation and Watchman Point Cases

Simulation	Bearing Angle	Blue		Green		Red	
		TR	Bsky ^T	TR	Bsky ^T	TR	Bsky ^T
Observation Point	221.3	0.284	0.413	0.535	0.241	0.923	0.058
Watchman Point	238.4	0.326	0.188	0.575	0.242	0.93	0.177

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APPENDIX 13

Trace Element Information

This appendix contains trace element information concerning the proposed Harry Allen and Warner Valley powerplants. The tables presented in this appendix are:

<u>Table Number</u>	<u>Title</u>
1	Predicted Release of Trace Elements at the Proposed 2,000-MW Harry Allen Powerplant
2	Predicted Release of Selected Trace Elements at the Proposed 500-MW Warner Valley Powerplant
3	Highest Calculated Ground-Level Concentrations of Trace Elements at the Proposed 2,000-MW Harry Allen Powerplant
4	Maximum Ground-Level Concentrations of Trace Elements at the Proposed 500-MW Warner Valley Powerplant
5	Predicted Release of Selected Trace Elements at the Proposed 250-MW Warner Valley Powerplant
6	Maximum Ground-Level Concentrations of Trace Elements at the Proposed 250-MW Warner Valley Powerplant
7	Average Composition and Observed Range of 20 Trace Elements in Coal Ash and 7 Additional Trace Elements in 48 Wasatch Plateau Field Coal Samples

TABLE 1

Predicted Release of Trace Elements
at the Proposed 2,000-MW Harry Allen Powerplant

Element	Coal Analysis (ppm)	Element Availability After Coal Combustion (lb/day)	Fractionation After Coal Combustion ^a (lb/day)		Location After Fractionation ^a (lb/day)	
			Bottom Ash	Fly Ash	Bottom Ash	Precipitation Capture Emission ^b
Arsenic	11.0	687.0	6.0	681.0	6.0	680.7 0.3
Beryllium	5.4	338.0	57.0	281.0	57.0	274.0 7.0
Boron	210.0	13,125.0	1,580.0	11,537.0	1,588.0	10,920.0 617.0
Cadmium	0.27	17.0	3.0	14.0	3.0	13.4 0.6
Chromium	6.2	338.0	54.0	334.0	54.0	286.0 48.0
Cobalt	14.0	875.0	136.0	739.0	136.0	726.0 13.0
Copper	8.0	500.0	64.0	436.0	64.0	432.0 4.0
Fluorine	85.0	5,312.0	58.0	5,254.0	58.0	4,850.0 404.0
Lead	6.4	400.0	41.0	359.0	41.0	329.0 30.0
Manganese	38.0	2,375.0	411.0	1,964.0	411.0	1,936.0 28.0
Mercury	0.05	3.0	0.1	2.9	0.1	0.0 2.9
Nickel	15.0	938.0	128.0	810.0	128.0	639.0 171.0
Selenium	1.0	62.0	1.0	61.0	1.0	38.0 23.0
Uranium	4.0	250.0	45.0	205.0	45.0	201.0 12.0
Vanadium	7.8	488.0	75.0	413.0	75.0	401.0 12.0

Source: Nevada Power Company, 1975

^aBased on trace element analysis according to EPA (1975).

^bAssumes no capture by sulfur dioxide scrubber.

NOTE: Calculations based on 31,250 tons of coal burned per day, plant operating on full load, ash content 8.2 percent.

ppm - parts per million
lb/day - pounds per day

TABLE 2

Predicted Release of Selected Trace Elements
at the Proposed 500-MW Warner Valley Powerplant

Element	Coal Analysis (ppm)	Elements Generated (lb/day)	Percentage Released to Atmosphere ^a	Stack Emission ^b (lb/day)
Arsenic	11.0	178.0	0.1	0.2
Beryllium	5.4	87.4	2.0	1.8
Boron	210.0	3,397.0	4.7	160.0
Cadmium	0.27	4.4	4.5	0.2
Chromium	6.2	10.0	12.0	1.2
Cobalt	14.0	226.5	1.5	3.4
Copper	8.0	129.4	0.8	1.0
Fluorine	85.0	1,375.0	7.6	105.0
Lead	6.4	103.5	7.5	7.8
Manganese	38.0	614.9	1.2	7.5
Mercury	0.05	0.8	98.8	0.8
Nickel	15.0	242.6	18.2	44.1
Selenium	1.0	16.1	37.9	6.1
Uranium	4.0	64.7	1.4	0.9
Vanadium	7.8	126.2	2.4	3.1

Source: EPA, 1975; Nevada Power Company, 1975

^aBased on trace element study, EPA, 1975.

^bAssumes no capture by sulfur dioxide scrubber.

Note: Calculations based on maximum operating capacity, 8,090 tons of coal burned per day.

ppm - parts per million

lb/day - pounds per day

TABLE 3

Highest Calculated Ground Level Concentrations of Trace Elements
at the Proposed 2,000-MW Harry Allen Powerplant

Element	Emission Rate (lb/day)	Maximum 24-hour Concentration ^a ($\mu\text{g}/\text{m}^3$)	Annual Average ^b ($\mu\text{g}/\text{m}^3$)
Arsenic	0.3	0.0002	0.00002
Beryllium	7.0	0.004	0.0006
Boron	617.0	0.33	0.053
Cadmium	0.6	0.0003	0.00005
Chromium	48.0	0.026	0.004
Cobalt	13.0	0.007	0.001
Copper	4.0	0.002	0.0003
Fluorine	404.0	0.21	0.035
Lead	30.0	0.016	0.0026
Manganese	28.0	0.015	0.0024
Mercury	2.9	0.0015	0.0002
Nickel	171.0	0.09	0.015
Selenium	23.0	0.012	0.002
Uranium	4.0	0.002	0.0003
Vanadium	12.0	0.006	0.001

Source: Nevada Power Company, 1975

^aBased on maximum plant operating capacity.

^bBased on 80-percent average plant operating capacity.

NOTE: Assumes 99.75-percent precipitator and scrubber capture.

$\mu\text{g}/\text{m}^3$ - micrograms per cubic meter

TABLE 4

Maximum Ground-Level Concentrations of Trace Elements
at the Proposed 500-MW Warner Valley Powerplant

Element	$\mu\text{g}/\text{m}^3$				
	Annual	Calculated		Background	
		Maximum 24-Hour	Maximum 3-Hour	Average ^a	Maximum ^b 24-Hour
Arsenic	0.00007	0.0007	0.003	0.001	....
Beryllium	0.0006	0.006	0.02	0.00004	....
Boron	0.06	0.6	2.1	0.007	....
Cadmium	0.00007	0.0007	0.003	0.0001	NM
Chromium	0.0004	0.004	0.02	0.008	0.01
Cobalt	0.001	0.01	0.04	0.0006	0.03
Copper	0.0004	0.004	0.01	0.03 ^b 0.09 ^b	0.27
Fluorine	0.04	0.4	1.4	0.3	....
Lead	0.003	0.03	0.1	0.01 ^b 0.04 ^b	0.24
Manganese	0.003	0.03	0.1	0.1	0.04
Mercury	0.0003	0.003	0.01	.....	....
Nickel	0.02	0.2	0.6	0.004	0.03
Selenium	0.002	0.02	0.08	0.0003	....
Uranium	0.0003	0.003	0.01	.....	....
Vanadium	0.001	0.01	0.04	0.004	....

Source: Adapted from ERT, 1976 and EPA, 1976.

^aBased on 6 days of sampling at Warner Valley site, 1975.

^bBased on 8 months of sampling by EPA at Bloomington and Pipe Spring, 1976.

Note: $\mu\text{g}/\text{m}^3$ - micrograms per cubic meter
NM - not measurable

TABLE 5

Predicted Release of Selected Trace Elements
at the Proposed 250-MW Warner Valley Powerplant

Element	Coal Analysis (ppm)	Elements Generated (lb/day)	Percentage Released to Atmosphere ^a	Stack Emission ^b (lb/day)
Arsenic	11.0	89.0	0.1	0.1
Beryllium	5.4	43.7	2.0	0.9
Boron	210.0	1,698.5	4.7	80.0
Cadmium	0.27	2.2	4.5	0.1
Chromium	6.2	5.0	12.0	0.6
Cobalt	14.0	113.2	1.5	1.7
Copper	8.0	64.7	0.8	0.5
Fluorine	85.0	687.5	7.6	52.5
Lead	6.4	51.7	7.5	3.9
Manganese	38.0	307.4	1.2	3.7
Mercury	0.05	0.4	98.8	0.4
Nickel	15.0	121.3	18.2	22.1
Selenium	1.0	8.1	37.9	3.1
Uranium	4.0	32.4	1.4	0.5
Vanadium	7.8	63.1	2.4	1.5

Source: EPA, 1975 and Nevada Power Company, 1975

^aBased on trace element study, EPA, 1975.

^bAssumes no capture by sulfur dioxide scrubber.

NOTE: Calculations based on maximum operating capacity, 4,045 tons of coal burned per day, 99.75-percent electrostatic precipitator and scrubber capture.

ppm - parts per million

lb/day - pounds per day

TABLE 6

Maximum Ground-Level Concentrations of Trace Elements
at the Proposed 250-MW Warner Valley Powerplant

Element	$\mu\text{g}/\text{m}^3$				
	Annual	Calculated		Background	
		Maximum 24-Hour	Maximum 3-Hour	Average ^a	Maximum ^b 24-Hour
Arsenic	0.000035	0.00035	0.0015	0.001	....
Beryllium	0.0003	0.003	0.01	0.00004	....
Boron	0.03	0.3	1.1	0.007	....
Cadmium	0.000035	0.00035	0.0015	0.0001	NM
Chromium	0.0002	0.002	0.01	0.008	0.01
Cobalt	0.0005	0.005	0.02	0.0006	0.03
Copper	0.0002	0.002	0.005	0.03 ^b 0.09 ^b	0.27
Fluorine	0.02	0.2	0.7	0.3	....
Lead	0.0015	0.015	0.05	0.01 ^b 0.04 ^b	0.24
Manganese	0.0015	0.015	0.05	0.1	0.04
Mercury	0.00015	0.0015	0.005	.....	....
Nickel	0.01	0.1	0.3	0.004	0.03
Selenium	0.001	0.01	0.04	0.003	....
Uranium	0.00015	0.0015	0.005	.....	....
Vanadium	0.0005	0.005	0.02	0.004	....

Source: Adapted from ERT, 1976 and EPA, 1976, and adjusted to 250-MW capacity plant.

^aBased on 6 days of sampling at Warner Valley site, 1975.

^bBased on 8 months of sampling by EPA at Bloomington and Pipe Spring, 1976.

NOTE: There is an assumed 99.75 percent capture by electrostatic precipitator and SO₂ scrubber.

$\mu\text{g}/\text{m}^3$ - micrograms per cubic meter

NM - not measurable

TABLE 7

Average Composition and Observed Range Of 20 Trace Elements
in Coal Ash and 7 Additional Trace Elements
in 48 Wasatch Plateau Field Coal Samples

Oxide or Element	Average ^a (ppm)	Observed Range	
		Minimum (ppm)	Maximum (ppm)
<u>Trace Elements In Ash</u>			
Boron (B)	1,000.0	200.0	3,000.0
Barium (Ba)	700.0	70.0	3,000.0
Beryllium (Be)	15.0	<3.0	50.0
Cadmium (Cd)	0.9	1.0	2.0
Cobalt (Co)	15.0	<10.0	50.0
Chromium (Cr)	100.0	30.0	200.0
Copper (Cu)	95.0	32.0	266.0
Gallium (Ga)	30.0	10.0	70.0
Lithium (Li)	111.0	15.0	288.0
Molybdenum (Mo)	10.0	<7.0	20.0
Niobium (Nb)	20.0	<20.0	50.0
Nickel (Ni)	50.0	10.0	200.0
Lead (Pb)	55.0	<25.0	195.0
Scandium (Sc)	20.0	<10.0	50.0
Strontium (Sr)	1,000.0	100.0	5,000.0
Vanadium (V)	100.0	70.0	300.0
Yttrium (Y)	70.0	30.0	300.0
Ytterbium (Yb)	7.0	3.0	15.0
Zinc (Zn)	84.0	19.0	237.0
Zirconium (Zr)	200.0	100.0	500.0
<u>Trace Elements In</u>			
<u>Whole Coal</u>			
Arsenic (As)	1.0	<0.5	3.0
Fluorine (F)	70.0	<20.0	240.0
Mercury (Hg)	0.05	0.01	0.21
Antimony (Sb)	0.3	<0.1	0.7
Selenium (Se)	1.7	0.8	5.7
Thorium (Th)	1.7	<3.0	5.2
Uranium (U)	1.3	0.2	3.5

Source: USDI, 1979.

^aArithmetic mean.

NOTE: ppm - parts per million

APPENDIX 14

Calculations of Estimated Impacts of Primary and Secondary Particulates Due to the Harry Allen Powerplant on the Las Vegas Nonattainment Area

A first approximation analysis was performed to determine whether the combination of particulates emitted directly from the Harry Allen powerplant and the formation of secondary particulates due to conversion of SO_2 and NO_x to sulfates and nitrates would impact the Las Vegas nonattainment areas at levels at or above the Environmental Protection Agency (EPA) significance levels. The EPA significance levels are $5.0 \mu\text{g}/\text{m}^3$ for maximum 24-hour concentrations, and $1.0 \mu\text{g}/\text{m}^3$ for annual average concentrations. If increased concentrations in a nonattainment area from a new or modified source would be greater than the significance levels for those pollutants for which the area is designated nonattainment, then a nonattainment review is required.

Radian (1980) calculated the maximum 24-hour impact of primary particulates from the Harry Allen powerplant to be $1.6 \mu\text{g}/\text{m}^3$ in Las Vegas. The annual average primary particulate impact was calculated to be $0.1 \mu\text{g}/\text{m}^3$. Emission rates, for the Harry Allen plant used by Radian were based on the Best Available Control Technology (BACT) determination for the Warner Valley powerplant and were as follows:

Total Suspended Particulates (TSP)	=	343.2 grams/second
Sulfur Dioxide (SO_2)	=	1,713.6 grams/second
Nitrogen Oxides (NO_x)	=	5,720.0 grams/second

Ratioing the emission rates of SO_2 and NO_x to the emission rate of TSP, and then multiplying by the maximum primary particulate impact in Las Vegas, maximum 24-hour and annual average SO_2 and NO_x impacts in Las Vegas can be obtained. These calculations give:

$$\text{SO}_2 \text{ concentration} = \frac{\text{SO}_2 \text{ emission rate}}{\text{TSP emission rate}} \times \text{TSP concentration}$$

$$\text{Maximum 24-hour SO}_2 \text{ concentration} = \frac{1,713.6 \text{ g/s}}{3,43.2 \text{ g/s}} \times 1.6 \mu\text{g}/\text{m}^3 = 8 \mu\text{g}/\text{m}^3$$

$$\text{Annual average SO}_2 \text{ concentration} = \frac{1,713.6 \text{ g/s}}{343.2 \text{ g/s}} \times 0.1 \mu\text{g}/\text{m}^3 = 0.5 \mu\text{g}/\text{m}^3$$

Similarly for NO_x ,

$$\text{Maximum 24-hour NO}_x \text{ concentration} = \frac{5,720.0 \text{ g/s}}{343.2 \text{ g/s}} \times 1.6 \mu\text{g}/\text{m}^3 = 26.7 \mu\text{g}/\text{m}^3$$

$$\text{Annual average NO}_x \text{ concentration} = \frac{5,720.0 \text{ g/s}}{343.2 \text{ g/s}} \times 0.1 \mu\text{g}/\text{m}^3 = 1.67 \mu\text{g}/\text{m}^3$$

These values assume no conversion of SO_2 to sulfates or NO_x to nitrates. The resultant concentrations of sulfates and nitrates can be calculated from the above SO_2 and NO_x concentrations if conversion rates, transport times, and chemical composition of secondary particulates are assumed.

Conservatively high values of SO_2 to sulfate and NO_x to nitrate conversions were chosen from the literature to maximize impact calculations. A SO_2 to sulfate conversion rate of 0.03/hour (3 percent/hour) was chosen (Cox and Penkett, 1972). A NO_x to nitrate conversion rate of 0.008/hour was chosen (Gordon and Bryan, 1973) and it was assumed that all NO_x was in the form of NO_2 . Both of these rates were measured in an urban environment.

A wind speed of 2.0 m/s was assumed. Transport to Las Vegas (40 km) would take 5.6 hours, thus, conversion to sulfate and nitrate would be:

$$\begin{aligned}\text{sulfate} &= .03/\text{hour} \times 5.6 \text{ hours} = 0.168 \\ \text{nitrate} &= .0008/\text{hour} \times 5.6 \text{ hours} = 0.0045\end{aligned}$$

Assume all sulfate is ammonium sulfate $(\text{NH}_4)_2\text{SO}_4$, molecular weight = 132 and all nitrate is ammonium nitrate, NH_4NO_3 molecular weight = 80.

Multiplying the SO_2 and NO_x concentrations in Las Vegas by the conversion factors and the ratio of molecular weights of $\text{SO}_2/(\text{NH}_4)_2\text{SO}_4$ and $\text{NO}_2/\text{NH}_4\text{NO}_3$, the increased concentrations of secondary particulates in Las Vegas would be:

$$24\text{-hour } (\text{NH}_4)_2\text{SO}_4 = 8.0 \mu\text{g}/\text{m}^3 \times 0.168 \times \frac{132}{64} = 2.77 \mu\text{g}/\text{m}^3$$

$$24\text{-hour } \text{NH}_4\text{NO}_3 = 26.7 \mu\text{g}/\text{m}^3 \times 0.0045 \times \frac{80}{46} = 0.21 \mu\text{g}/\text{m}^3$$

$$24\text{-hour total ammonium sulfate and ammonium nitrate} = 2.99 \mu\text{g}/\text{m}^3$$

Adding secondary particulates to primary particulates result in $1.6 \mu\text{g}/\text{m}^3 + 2.99 \mu\text{g}/\text{m}^3 = 4.59 \mu\text{g}/\text{m}^3$ total particulate increase from the Harry Allen powerplant on the nonattainment area, which is less than the $5.0 \mu\text{g}/\text{m}^3$ significance level.

For annual average increased concentrations from secondary particulate formation:

$$\text{Ammonium sulfate} = 0.5 \mu\text{g}/\text{m}^3 \times 0.168 \times \frac{132}{64} = 0.17 \mu\text{g}/\text{m}^3$$

$$\text{Ammonium nitrate} = 1.67 \mu\text{g}/\text{m}^3 \times 0.0045 \times \frac{80}{46} = 0.01 \mu\text{g}/\text{m}^3$$

$$\text{Total secondary particulate formation} = 0.18 \mu\text{g}/\text{m}^3$$

Adding primary and secondary particulate increases from the Harry Allen powerplant on the nonattainment area, the result is $0.28 \mu\text{g}/\text{m}^3$, which is below the significance level of $1.0 \mu\text{g}/\text{m}^3$.

In conclusion this analysis, using conservative assumptions, indicates that the TSP impacts from the Harry Allen powerplant on the Las Vegas non-attainment area would be below levels designated by EPA as significant. These results are summarized below:

Maximum Estimated Particulate Impacts to Las Vegas
Nonattainment Area From the Harry Allen Powerplant

	<u>24-hour ($\mu\text{g}/\text{m}^3$)</u>	<u>Annual ($\mu\text{g}/\text{m}^3$)</u>
Primary Particulates	1.6	0.10
Secondary Sulfates	2.8	0.17
Secondary Nitrates	0.2	0.01
Total Particulates	4.6	0.28
EPA Significance Levels	5.0	1.0

A case not considered by this study was a stagnation condition, with resulting buildup of primary and secondary particulates followed by transport into the nonattainment area.

U.S. Fish and Wildlife Service Official Biological Opinion
(October 1980)
and Fish and Wildlife Coordination Act Technical Assistance
Report



United States Department of the Interior

FISH AND WILDLIFE SERVICE
AREA OFFICE COLORADO-UTAH
1311 FEDERAL BUILDING
125 SOUTH STATE STREET
SALT LAKE CITY, UTAH 84138
October 15, 1980

IN REPLY REFER TO

FA/SE/BLM--Allen-Warner
Valley (6-5-77-F-18)

MEMORANDUM

To: State Director
Utah State Office
Bureau of Land Management
Salt Lake City, Utah

From: Area Manager
Area 5
Fish and Wildlife Service
Salt Lake City, Utah

Subject: Section 7 Consultation on the Woundfin--
Allen-Warner Valley Energy System

This biological opinion was prepared pursuant to Section 7 of the Endangered Species Act (ESA) and in reply to your memorandum of December 28, 1979. This opinion addresses expected effects of the Allen-Warner Valley Energy System (AWVES) on the woundfin.

BIOLOGICAL OPINION

The proposed project is likely to jeopardize the continued existence of the woundfin. Critical habitat has not been designated for this species.

PROJECT DESCRIPTION

The Bureau of Land Management (BLM) is evaluating the proposed AWVES because the project sponsors have applied for right-of-way permits to use public land. BLM described the purpose of the proposed AWVES in the draft environmental impact statement (EIS) issued in June 1980. BLM stated the purpose is to meet the base load energy needs of the Nevada Power Company, Southern California Edison, Pacific Gas and Electric, and the City of St. George, Utah. Under the project sponsors' proposal, the AWVES would consist of a coal field in south-central Utah; a 500-megawatt power plant near St. George, Utah; a 2,000-megawatt power plant near Las Vegas including facilities to transport cooling

water from an existing wastewater treatment plant; coal slurry pipelines to run from the coal field to the two powerplants; and an electric transmission system. A water project is planned in conjunction with the generating station at St. George, and it would include a diversion dam on the Virgin River, an offstream dam and reservoir in Warner Valley, and a system of canal pipelines. This proposed Warner Valley Water Project is sponsored by the Washington County Water Conservancy District (District) who considers it as separate from, although related to, the AWWES. According to the District, the major purpose for the Warner Valley Water Project is to provide water for several southern Utah communities, and a secondary purpose is to provide cooling water to the Warner Valley powerplant.

Uses of the water from the proposed 55,000 acre-foot reservoir would be as cooling water for the Warner Valley powerplant (10,000 acre-feet), as supplementary irrigation water (8,000 acre-feet), as a source of municipal and industrial water (26,400 acre-feet), and as reserve for the powerplant and for dead storage (10,600 acre-feet). These figures indicate storage capabilities of the reservoir but have no relationship to stream flows.

HISTORY AND STATUS OF CONSULTATION

BLM requested consultation on the AWWES in August 1977, and the Fish and Wildlife Service (FWS) issued a biological opinion in April 1978. Among other topics covered, the biological opinion recommended the monitoring of potentially toxic emissions of trace elements such as mercury and arsenic from the Harry Allen powerplant. Our concern was that the Moapa dace, bald eagle, woundfin, and peregrine falcon (all listed species) might be impacted if levels of toxicants were to accumulate through the respective food chains. The monitoring and the bioassay work that we recommended in our 1978 biological opinion still seem appropriate safeguards, thus we reiterate our earlier request.

The 1978 opinion dwelled primarily on the woundfin and recommended certain flows in the Virgin River for the welfare of this endangered fish. In addition, flow recommendations for the woundfin were made in a consultant's report prepared by Vaughn Hansen Associates for the City of St. George. The flow recommendations in the report were considerably less than those recommended by FWS in the 1978 opinion. The District contended that the flows recommended by FWS were higher than needed to maintain the woundfin population and that adherence to FWS's recommendations would preclude development of the Warner Valley Water Project. Because of changes in the design of the AWWES, new alternatives, and slightly increased flows offered by the District, BLM reinitiated formal consultation on December 28, 1979. Initially, we responded by issuing a biological opinion and conference report on July 31, 1980, on three listed plant species and the desert tortoise which was proposed for listing at that time. This biological opinion on the woundfin completes our response to your December 1979 memorandum. BLM and FWS agreed to extend the consultation period for this opinion until September 15, so that a special field study could be conducted on the woundfin. On September 12, an additional short extension for completion of the consultation was granted to FWS by BLM so that an issue concerning historical flows could be resolved.

When BLM reinitiated consultation, the desert tortoise and the Virgin River roundtail chub were proposed to be listed as endangered species. Subsequently, the tortoise was listed as threatened on August 20, 1980, but the proposal to list the roundtail chub was withdrawn. Further consultation concerning the effects of the AWWES is not needed for the tortoise because that subject was covered in the July conference report. The roundtail chub is discussed in this report, but we are not consulting on this species nor recommending specific river flows for its well-being.

On August 5, 1980, we received a letter from the Office of Surface Mining (OSM) which pointed out that mining of the Alton coal fields could reduce stream flows in the East Fork of the Virgin River, thereby possibly impacting the woundfin. OSM asked that this consultation between FWS and BLM be broadened to include OSM's pending decision whether to designate Federal lands in the Alton area as unsuitable for mining. FWS and BLM have agreed to this approach with BLM serving as lead agency. This biological opinion addresses OSM's interests, and a copy is being sent to that agency.

BASIS OF OPINION

STATUS AND DISTRIBUTION OF THE WOUNDFIN

Listed as endangered in October 1970, the woundfin is a streamlined silvery minnow with a flattened head and a conspicuous sharp dorsal spine, from which its common name was derived. The woundfin is listed as endangered because loss of habitat and habitat modifications have greatly reduced its former range. Figure 1 illustrates the historic range of the species whereas Figures 2 and 3 illustrate its current distribution. Reservoirs, physical barriers to movement, water diversions, and pollution are the main reasons woundfin are endangered.

Historically, the original range of the woundfin extended from near the junction of the Salt and Verde rivers at Tempe, Arizona, to the mouth of the Gila River at Yuma, and thence upstream to the Virgin River system in Utah. However, from biological considerations alone, there is good reason to believe that the woundfin occurred further up stream on the Verde, Salt, and Gila rivers.

A series of dams on the Colorado River, beginning with the construction of Hoover Dam in the early 1930's, has eliminated all woundfin habitat in the lower Colorado River Basin. The lower end of the Virgin River and the Moapa River became unsuitable for the woundfin when Lake Mead was filled. Irrigation diversions and introduction of non-native species have reduced the suitability of the remaining habitat.

In their present range, woundfin populations exist at reduced numbers from the irrigation diversion at Mesquite, Nevada, to Lake Mead. Woundfin have never lived on a year-round basis in the Virgin River Gorge as the river flow is intermittent there. Above the Gorge, the woundfin lives below and above the Washington Fields Diversion up to LaVerkin Springs. The hot mineralized LaVerkin Springs is the upper limit of the woundfin distribution.

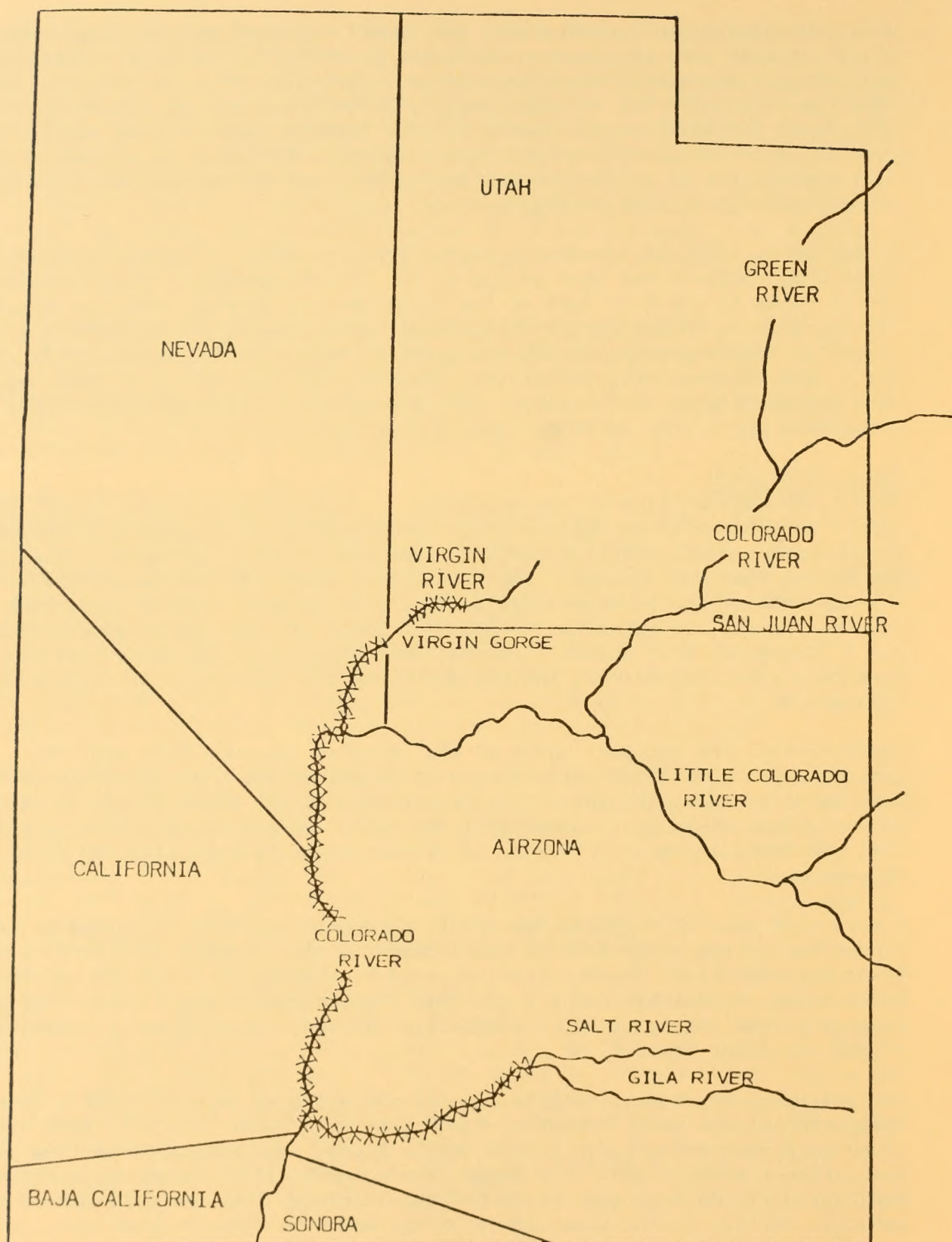


Figure 1. Known historic distribution of the woundfin in the Colorado River System.

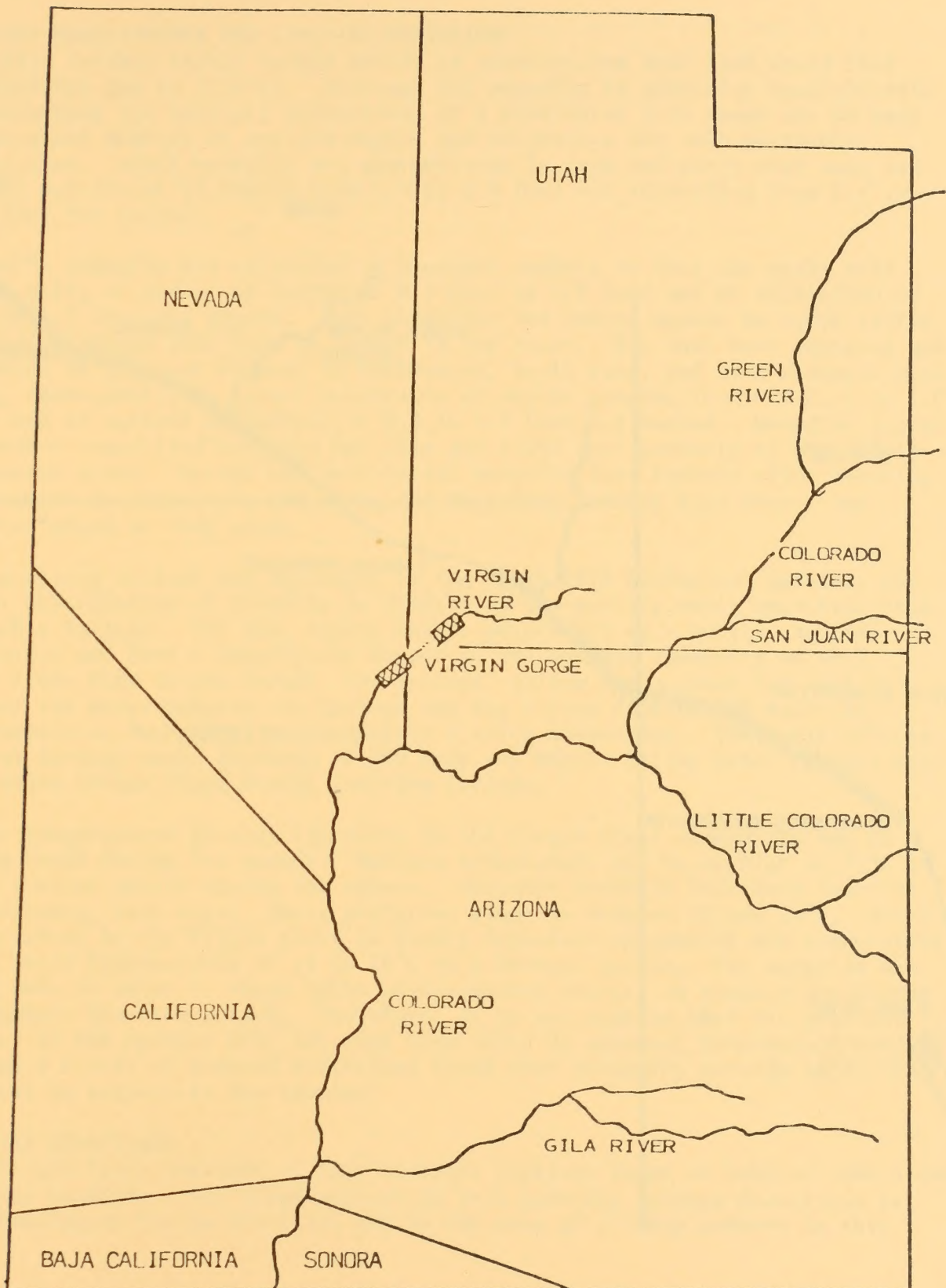


Figure 2. Present distribution of the woundfin minnow in the Virgin River.

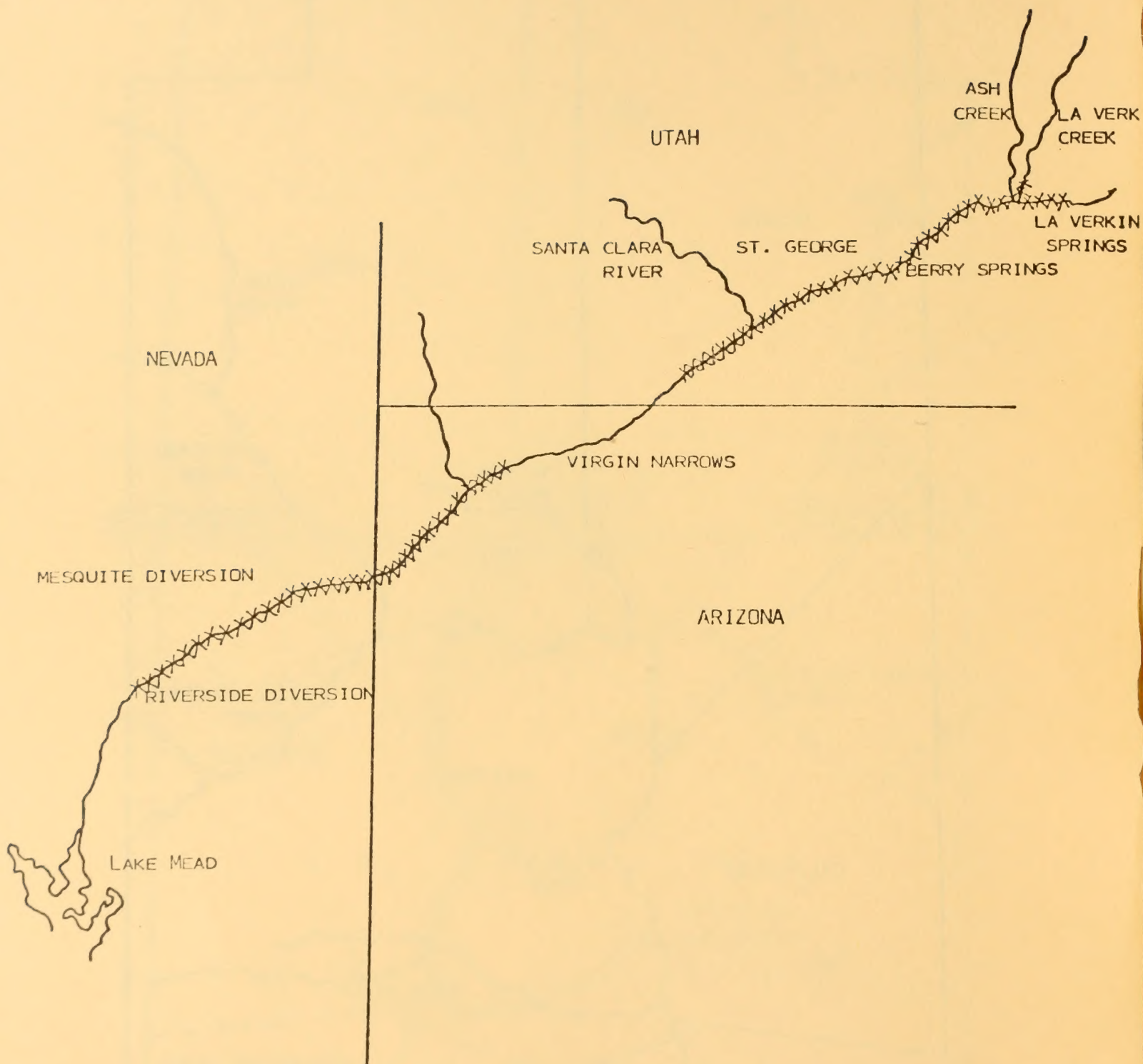


Figure 3. Present distribution of the woundfin in the Virgin River.

HABITAT REQUIREMENTS AND LIMITING CONDITIONS

Woundfin inhabit highly turbid waters at temperatures most fish would find intolerable (up to 37.6°C). Although the woundfin is generally opportunistic in selecting its habitat, collections of a particular life stage can be made in greatest numbers at certain depths and velocities and over particular substrates. Adult woundfin are concentrated in runs and pools over sand and gravel substrates at depths from 1.0 to 2.6 feet and velocities from 0.9 to 1.9 feet per second.

Juvenile woundfin are collected in greatest numbers in runs and pools over sand, silt, or gravel at depths of 0.3 feet to 1.9 feet and at velocities of 0.6 to 1.3 feet per second. Both juveniles and adults appear to avoid riffle habitat although this type is common in the river. Fry have been captured and observed in greatest numbers in backwaters, small runs, and side channels over sand, sand-cobble, or gravel substrates at depths ranging from 0.3 feet to 1.0 feet and at current velocities of 0.3 to 1.0 feet per second. Woundfin appear to prefer unmodified habitats but also are found less commonly in physically disturbed areas. Larval and post-larval woundfin live inshore after hatching and remain in backwaters and along the shoreline, moving into deeper and swifter areas as they grow.

As mentioned earlier and discussed in the April 1978 biological opinion, the upper distribution of woundfin is limited by low-quality water emanating from LaVerkin Springs. The hot, highly saline waters act as a barrier to fish migration and have a significant impact on the benthic community as well. When river flow is the lowest, the Springs' inflow may account for more than 95% of the water between the Springs and the inflow from the CP National Hydroelectric Powerplant approximately 2 miles downstream. The toxic effects of the Springs would increase if the proposed Warner Valley Water Project were to reduce stream flows during low-flow periods.

Water temperatures greatly fluctuate in the Virgin River seasonally and on a daily basis during the summer. Maximum temperature can be as high as 37°C in very shallow waters during the summer. Although woundfin have been observed in extremely warm water, their preferred range is between 22 and 26°C. Water temperature in the Virgin River is highly dependent on ambient air temperature with daily fluctuations of 14 to 16°C in a 24-hour period. The woundfin has been able to adapt to these harsh environmental changes in temperature during the summer low-flow period. Therefore, it is our opinion that the greatest impact to the species will not come from daily or seasonal temperature changes but as a result of reduced historical flows that presently provide sufficient habitat to perpetuate the species.

HABITAT CONDITIONS

The Virgin River consists of four distinct sections based on habitat conditions for the woundfin. The first section is from LaVerkin Springs downstream to the Washington Fields Diversion and is the area of primary concern in this

biological opinion. This section is the least disturbed habitat throughout the range of the woundfin and would be impacted the most by the AWVES. This section is made up of steep canyon reaches where the river narrows considerably and the water is highly turbulent, with deep pools and shallow riffles being separated by short runs.

The second and fourth sections of the river are very similar to each other. Both sections occur below major diversions (Washington Field Diversion and Mesquite Diversion) and experience greatly reduced flows annually. Impact from the AWVES would be minimal. The river habitat in these two sections is composed of wide channel reaches with widths often over 200 feet. The gradient is low, and flow through these two sections is laminar and calm. Pools and riffles are not as abundant as runs and, when present, the pools are not as deep as in the first section of the river discussed above. The habitat below the diversions is marginal at best and the populations of woundfin often suffer high mortality during summer low-flow conditions. These populations are sustained by the fish that are moved downstream by the runoff and by recruitment of young into the population after the spawning season.

Section three, below the Virgin River Narrows, has a constant water source from the Littlefield Springs. This section is similar to section one in that it contains good habitat and sustains a moderately good population of woundfin. Habitat in section three is similar to sections two and three with wide channels and slow laminar flow; however, the constant water source provides habitat to sustain the woundfin population. As with sections two and three, impact to this section of the river from the AWVES project would be extremely small.

PROJECT IMPACTS ON WOUNDFIN HABITAT

As discussed in our 1978 biological opinion, the primary effect of the AWVES would be on the flow of the Virgin River. Even with the modifications of the diversion bypass proposed by the applicant in December 1979, the main effect is still reduced flows in the Virgin River during winter and spring (November-June) with approximately one-half the average flow being diverted to the proposed Warner Valley Reservoir.

Our 1978 biological opinion was based on historical hydrologic conditions as measured at the United States Geological Survey (USGS) Hurricane gage. The analysis consisted of examining frequency of occurrence of low-flow conditions over an 11-year period, at three critical time periods or life stages of the woundfin. The opinion was based on the premise that past historic conditions have provided the needed environmental and biological conditions for a viable self-sustaining population of woundfin.

Based on historic flows from 1967 to 1977, we recommended flows of 110 cubic feet per second (cfs) during November-February, 110 cfs during March-June, and 70 cfs during June-October. We also stated the natural flows would be acceptable even if the volumes are lower than our recommendations.

Although the modification in the diversion bypass proposed by the applicant was small, BLM believed it was sufficient to request consultation. At BLM's request, we reentered consultation. However, we informed BLM that the conclusion of our 1978 biological opinion would not change unless new information could be obtained that would indicate reduced impacts to the woundfin. We pointed out that more field data should be gathered and that a longer, more detailed analysis would be necessary. It was agreed that we would undertake an in-depth study of the Virgin River and the woundfin using the instream flow incremental methodology. It was concluded that use of the newly developed instream flow methodology and historical flow data together should provide a sufficient base for a new biological opinion. Therefore, the recommended flows in this biological opinion are based not only on actual historical water conditions of the Virgin River but also on a simulated model of habitat availability as given by the instream flow method.

Impact Analysis Based on Historical Flow

As in our 1978 opinion, we examined the historical flow of the Virgin River as measured at the Hurricane USGS gage. This gage was selected as a point of reference because it is below the Hurricane Diversion where the flows would be diverted to the Warner Valley Reservoir and above the Washington Fields Diversion which controls downstream flow of the Virgin River during much of the year. In addition, this river section supports a relatively good population of woundfin, and project impacts would be greatest in this reach. Therefore, if flows can be maintained at this point in the river, it is our opinion the impact to the woundfin from the AWWES would be greatly reduced or eliminated.

We examined the flows for the period of record for the Hurricane gage from 1967 to 1979 (13 years). Simulated flows at the Hurricane gage have been computed by the Utah Division of Water Resources for a 40-year period (1935-1975) and were used in a report on the Virgin River by Vaughn Hansen Associates (1977) and in the draft EIS. However, we elected to use only the actually recorded data for the Hurricane gage because correlation was poor between the flows measured at the Virgin gage and the Hurricane gage from which the simulated flows were derived. Because of the strong possibility of error between the simulated flows and the actual measured flows, we chose to use only the actual flow data even though these data covered a shorter period (13 years as compared to 40 years for the simulated data).

Results

The frequency of occurrence of low flows was calculated on the basis of 11 years of data for our 1978 biological opinion. For our present analysis, we were able to add in the data gathered during the 2 years from 1978 to 1980. Using the 13 years of data, we concluded the frequency of occurrence of low flows from 1978 to the present did not change greatly. For the winter period from November through February, 121 to 130 cfs was the lowest flow which occurred consistently (10 out of 13 years) over the 13-year period. The median flow for the same period was 140 to 150 cfs. From March through June, 91 to 100 cfs was the lowest flow that occurred consistently 10 out of the past 13 years with most of the low-flow days occurring in June. Median flow

for this spring period was 111 to 120 cfs. For the summer period from July through October, 71 to 80 cfs occurred consistently 12 out of 13 years. The median flow for the same period was also 71 to 80 cfs.

If we were to recommend flows based only on historical conditions, they would be very similar if not the same as those recommended in 1978. The only period that changed from the 11 year record in our 1978 opinion was during winter conditions. Lowest flows that consistently occurred in 1978 were 101 to 110 cfs for 8 out of the 11 years. The water year 1978 was an average water year while 1979 was a relatively high water year. These two years increased the level of low flows that occurred most frequently during winter months.

Impact Analysis Based on Instream Flow Method

A joint FWS, BLM, and Utah Division of Wildlife Resources (UDWR) study was initiated during May 1980. The study was done with two main objectives: 1) to assess the proposed project impact on the woundfin and 2) to determine flows that would provide the greatest habitat for the different life stages of the endangered species.

The newly developed instream flow methodology uses two basic programs (IFG-2, IFG-4) depending on the river flow, morphology, and other aquatic characteristics. Because of difficulty with the river bed shifting from one measured flow to another, we elected to run the IFG-2 hydraulic simulation program instead of the IFG-4 program. The IFG-2 program is an approved methodology and has been used by Water and Power Resources Service as well as several other agencies. The IFG-2 program coupled with a habitat program, developed by the FWS instream flow group (IFG) to assess project impact on a particular fishery, is designed to use selected habitat preferences of a species, and then compute the available habitat for selected life stages at a range of flows predicted by the hydraulic program.

In order to run the model, hydraulic data were collected on the Virgin River during the summer of 1980. In addition to the hydrologic data, a separate study was initiated with Dr. James Deacon of the University of Nevada, Las Vegas. The purpose of Dr. Deacon's study was to determine the selected preference values for the various parameters of the different life stages to be used in the habitat program. Without these data, we would not have been able to determine the available usable area for the predicted or measured flows.

Methods and Selection of Sites for the Instream Flow Analysis

In determining where sampling sites for the instream flow study were to be established, we first examined the entire existing range of the woundfin on aerial photos and topographical maps. We sectioned the river into river miles upstream from Lake Mead and then designated essential reaches for the woundfin, using available biological information. Determination of good habitat conditions for any species should be made in an area where the species is doing well and where there are the least human disturbances. Based on historical flow of the Virgin River, we knew the Washington Fields Diversion produces the single greatest impact on the woundfin anywhere above the Virgin River Narrows.

Therefore, we selected two study sites above the Washington Fields Diversion in two different habitat types (canyon and wide channel). In addition, we selected one site below the Washington Fields Diversion and one below the Narrows for comparison.

We carried out the study with field sampling assistance from UDWR and BLM. UDWR also assisted in data analysis. We collected hydrologic data at a high flow of approximately 680 cfs, a median flow of 240 cfs, and a low flow at 90 cfs as measured at the Hurricane gage. In addition, we assisted in the collection of biological data during three sampling trips. The IFG team in Fort Collins, Colorado, assisted in computer analysis and development of preference curves for the three life stages of the woundfin.

Simulated flows were calculated from low-flow and high-flow conditions. Available aquatic habitat per 1000 feet of stream was determined at each simulated flow for all stations and each life stage of the woundfin. The computed available habitat per 1000 feet of stream at each station was then multiplied by the percentage that particular site represented of the total study reach to give a total weighted usable area within the stream reach available for each life stage of the endangered species (Table 1).

Results

Based on the computed total weighted usable area, we found that 150 cfs provides more habitat for adult woundfin than does any other flow (Table 1). According to the computed values, the greatest available habitat for both the juvenile and fry stages occurs at 70 cfs.

Predicted flows below 70 cfs were not calculated because of the extrapolation error when predicting flows greater than or less than actually measured flows. From the table, we were unable to determine the exact flow that gives the greatest available habitat for fry and juvenile life stages. However, we know that 70 cfs provides more habitat for the two life stages than any other flow measured or predicted. Moreover, since 70 cfs was historically the most frequently occurring flow for the period from July through October when fry and juvenile are present in the river, we assumed it is providing sufficient habitat to maintain the two life stages.

To determine the flow needed on a monthly basis for the woundfin, we developed a graph showing the relative abundance and distribution of life stages during the water year (Fig. 4). As depicted in Figure 4, spawning occurs in mid-April and runs through the first of July. Fry or young-of-the-year usually appear the first of June and persist through the first of September. Juvenile fish will appear as early as the first of July and remain throughout the winter into March. Adult fish are present year-round.

A flow for a particular month can take into account from one to three life stages. Because certain life stages are brief and are extremely critical to the survival of the species, such as spawning or fry and juvenile rearing, flows should be recommended to insure the greatest available habitat is present

Table 1. Total amount of weighted usable area at two stations for the entire reach of the Virgin River from LaVerkin Creek to Washington Diversion. (Area in square feet)

<u>FLOW</u> <u>CFS</u>	<u>FRY</u>	<u>JUVENILE</u>	<u>ADULT</u>
70	56414.77*	33279.68*	41513.53
80	53798.27	32927.03	44614.88
90	50997.33	32503.05	46798.55
100	47706.83	31734.38	49021.80
110	44242.06	31708.27	50050.00
120	40470.60	31682.15	51259.96
130	37494.15	30900.97	51700.00
140	34867.69	29122.65	52325.00
150	32709.59	28376.706	52789.97*
160	30729.79	27695.54	52693.87
170	29290.63	26726.72	52100.00
180	28351.47	25708.61	52244.37
190	28017.39	24848.12	51800.00
200	24003.31	22284.19	44645.70
210	21600.00	21943.86	42900.00
220	19950.00	21603.53	42100.00
230	18100.00	21263.21	42000.00
240	16800.00	20922.89	41950.00
250	15572.61	18327.76	47734.01
260	15020.00	17920.55	37600.00
270	14650.00	17513.34	36750.00
280	14250.00	17106.21	35900.00
290	13800.00	16698.91	35300.00
300	13653.64	16291.72	35254.46
340		14851.02	
350	10532.51	14490.82	30459.61
360		13563.44	
370		12636.07	
380		11708.69	
390		10781.32	
400	8655.96	9853.94	27913.24
450	8532.00	15472.50	25422.50
500		13558.90	22856.90
600		11269.44	19563.37
700		11042.26	17417.65
800		11815.92	16226.94
900		12879.12	15500.19
1000		13205.54	14889.96

* Optimum flow based on the greatest amount of weighted usable area.

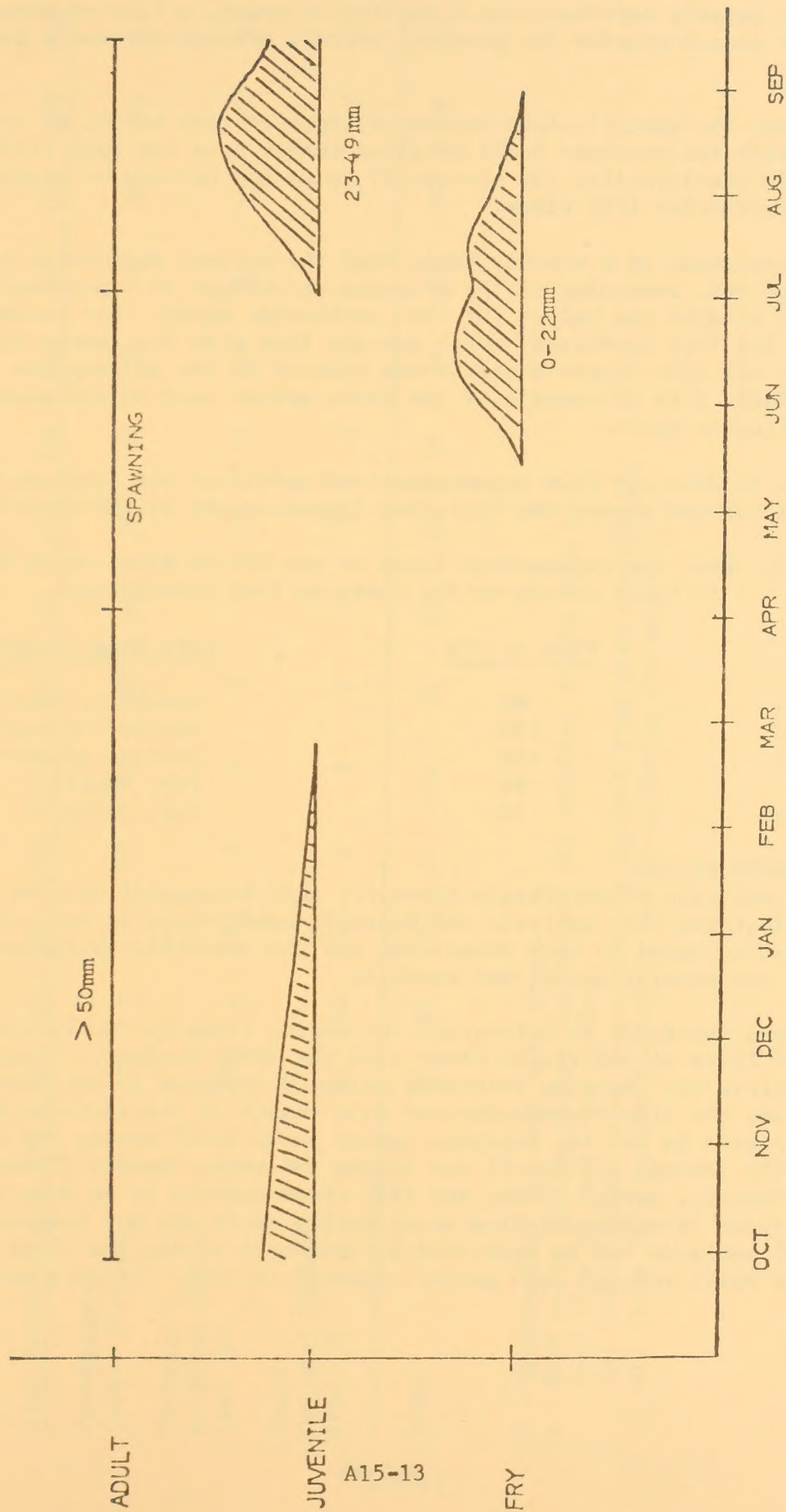


Figure 4. Presence of three life stages of woundfin in the Virgin River during a twelve month period.

for the life stage of greatest importance for that month. If two or more life stages are equally important for a particular month, a flow recommendation for that month should provide the greatest overall habitat available for all life stages.

To determine the specific flow recommendation for each month, we considered the flow with the greatest total weighted usable area for each life stage (70 cfs-fry, 70 cfs-juvenile, 150 cfs-adult) to be the optimum or preferred flow for that particular life stage.

We then determined on a monthly basis what the percent difference in weighted usable area was, according to the presence or absence of a particular life stage, and totaled the values for that particular month. Our recommendation of a flow for that particular month was the flow with the lowest total percent change for all life stages since it was closest to the optimum for all life stages. Table 2 is an example of the above method used in recommending flow for a particular month.

If we were to base our flow recommendations solely on the instream flow analysis discussed above, the following figures would be the result (Table 3).

Table 3. What the recommended flows in the Virgin River would be if based solely on the instream flow methodology.

<u>Month</u>	<u>Flow In CFS</u>	<u>Life Stage Considered</u>
Oct - Nov	90	Juvenile, Adults
Dec - Mar	120	Adults, Juvenile
Apr - May	150	Adults, spawning
June	90	Fry, Adults
July - Sept	70	Fry, Juvenile, Adults

FLOW RECOMMENDATIONS

Since our analysis of the Virgin River for this biological opinion consists of both the instream flow analysis and historic conditions, we want to make our recommendation based on both these data and the available biological data regarding the populations of the woundfin.

Figure 5 was developed to illustrate the median flows of the Virgin River and the median flows of the Virgin River with the AWVES project. Also, this figure depicts the low-flow frequency values determined in our historic flow analysis and the flow recommendations as a result of the instream flow method. The differences in the two analyses appear to be small during the summer months (July through September) and during the winter months (December through March). However, during spring and fall there appears to be some difference. The difference in estimated flow needs during April and May between the two methods of analysis can be explained because most of the low flows that occurred during the March through June period occurred in June. If June were not

Table 2. Example of flow determination for the month of August life stages of the woundfin.

		August median flow 102 cfs																	
Flow Increments in CFS		70	80	90	100	110	120	130	140	150	160	170	180	190	200	210			
Fry-Weighted Usable Area (n)		0	5	10	15	22	28	34	38	42	46	48	50	51	57	63			
	Juvenile Weighted Usable Area (n)	0	1	2	5	6	6	7	12	15	17	20	23	25	33	34			
Adult Weighted Usable Area (n)		21	16	11	7	5	3	2	1	0	1	2	3	4	15	19			
	Total	21	22	23	27	33	37	43	51	57	64	70	76	80	105	116			

- 0 - Optimum flow for each life stage
n - Each value is the percent difference the weighted usable area at that flow is away from optimum.
- The lowest total value represents the optimum flow when considering all three life stages present in the river during the month.

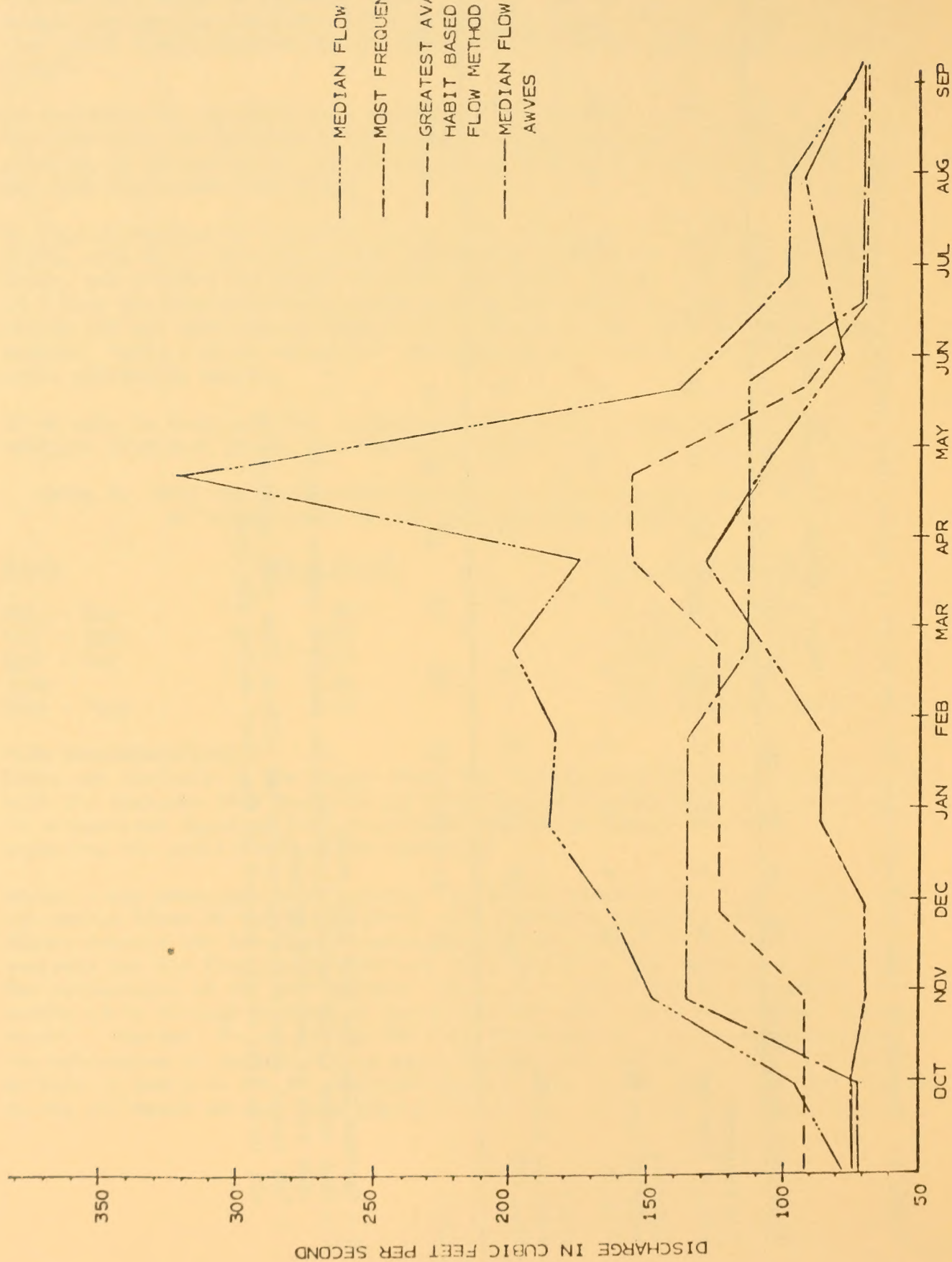


Figure 5. Historical median flow of the Virgin River(1967-1990), effects of the AWWES on historical median flow and two possible flow recommendations for the woundfin.

considered with the 4-month period, the low flow most frequently occurring would be between 140 and 160 cfs. It also appears the historical low-flow fall period may be somewhat limiting to juvenile and adult survival.

Based on both methods of flow analysis, we recommend that the following flows be maintained at the Hurricane gage to insure the survival of the woundfin (Table 4).

Table 4. Recommended flows in the Virgin River at the Hurricane Gage to support a viable Woundfin population.

<u>Month</u>	<u>Flow in CFS</u>	<u>Life Stage</u>
Nov-Feb	120	Juvenile, Adults, overwintering
Mar-June	120	Fry, Adult, spawning
July-Oct	80	Fry, Juvenile, Adults, Summer survival

The period of flow from November through February is critical for overwinter survival and recruitment of juvenile woundfin into the population. Based entirely on flow records, a recommendation could be made for 130 cfs. This flow consistently occurred 10 out of 13 years. The median flow for the same period is between 140 to 150 cfs. However, we concluded from the information gained from the instream flow method that the greatest available habitat for both life stages occurs at 120 cfs. Since a lower flow than what naturally is occurring would enhance habitat for the juvenile and adult woundfin and perhaps add to the success of survival for the species during the winter, we have determined 120 cfs or natural flow, whichever is less, would be the most desired of the flows studied during this period.

The period from March through June encompasses the high spring runoff and the spawning season. Data were not available on spawning requirements for incorporation into the instream flow analysis. However, we do know spawning begins as early as April and runs through June. Based on the frequency of historical low flows, 90 to 100 cfs occurs consistently over the 13-year period but as stated earlier, most of the low flows occur during June. Median low flow for the same period is 111 to 120 cfs. In addition, the instream flow analysis determined the following values: 120 cfs for March as optimum flow when juveniles and adults are present, 150 cfs during April and May as optimum flow when adults only are present, and 90 cfs during June when fry and adults are present. If spawning criteria were available, the determined optimum flow for April and May might be somewhat lower.

Because of the variability in the optimum flow for the life stages present in the river from March through June and based on the historical flow analysis, we determined 120 cfs or natural flow, whichever is less, would provide the greatest available habitat for the two life stages of the species. Moreover, 120 cfs was determined to be the median flow. Therefore, our recommended flow would be occurring at least 50 percent of the time.

The last period from July through October spans the summer low-flow period which is critical for young-of-the-year and juvenile survival, as well as adult survival. Flows naturally occurring during this period are consistently low. The lowest flow which occurred 12 out of 13 years was 71 to 80 cfs. Based on the instream flow predictive model, the greatest available habitat for all life stages of the woundfin would be at 70 cfs, except during October when 90 cfs would provide the greatest available habitat. Some adult woundfin die each summer either because of low flow conditions or because the fish are in poor physical condition as a result of spawning. We recommend 80 cfs or the natural flow, whichever is less, as the base flow for this period knowing it will provide sufficient flows for recruitment of young woundfin. It will also provide the most habitat for adult woundfin during the summer, possibly reducing the level of adult mortality.

It is our opinion that if these flows are maintained in the Virgin River at the Hurricane gage they will help sustain the woundfin at its present level and ultimately help increase the population so the species can be removed from the endangered species list.

Furthermore, it is our opinion, based on this present study, that any flow below the recommended optimum for a given month would jeopardize the woundfin. Flows during winter are critical for juvenile and adult survival. A reduction in flow from the recommended 120 cfs from November through March to 70 to 110 cfs, as proposed by the project sponsors for the same period, would greatly reduce available habitat in the Virgin River for both the juvenile and adult life stages. The potential reduction in flow (which would occur with the project) would favor the juvenile woundfin present in the river at that time, but it would greatly reduce adult habitat which is also essential. Our recommended flow of 120 cfs would reduce both adult and juvenile habitat but only to a level that would still sustain both life stages during that period of the year. Our primary concern is that with the proposed project, more adults and juveniles would die prior to spawning than now die under existing flows. This increased adult mortality during the winter would reduce the overall reproductive success of the woundfin population.

From a length-frequency analysis of the woundfin population from 1977 until the present time, it appears that the effects of low-flow conditions, such as those that occurred during the 1977 drought, are long-lasting and recovery of the population is slow.

From data collected since 1977, it appears 2- and 3-year-old adult woundfin are responsible for the primary spawning effort in a given year. In 1977, as a result of low winter and spring flows, spawning in the reach of the Virgin River from LaVerkin Springs to the Washington Fields Diversion was almost a complete failure, resulting in a poor 1977 year class. The effects of the poor reproductive success in 1977 was carried over to 1979, resulting in the absence of 2-year-old fish (1977 year class) in the 1979 collections. The

absence of the 2-year-old fish in 1979 resulted in another relatively low reproductive year. The overall effects of the reduced 1977 and 1979 woundfin year classes were evident in the extremely low juvenile and adult population sampled during the winter in 1979 and 1980 by the woundfin recovery team.

It is our opinion that the Warner Valley Water Project would affect the woundfin in much the same way as the drought in 1977, with its serious localized impacts on this fish. However, the Warner Valley Project impacts would occur yearly rather than once in 30 years.

Our recommended flows from June through November are within the range of historical flows. If spawning success for the woundfin is compared with historical flows during the summer and the low-flow period during the summer in 1977, it appears that good survival of woundfin fry and juveniles can occur under relatively low-flow conditions. This suggests that during normal water years, if woundfin spawn and hatch successfully, flows ranging from 70 to 80 cfs would be sufficient to provide rearing habitat. It is, therefore, the reductions in winter and spring flows that severely impact the woundfin population by increasing adult mortality in the winter and reducing the total spawning success in the spring.

It, therefore, is our opinion that any reduction in flows below the recommended monthly flows in Table 4 would greatly reduce the spawning and rearing success of the woundfin populations. Moreover, reduced flows during the winter and early spring have the potential of reducing the adult populations of woundfin, thereby jeopardizing the continued existence of the species.

Exotic Species Competition

In our 1978 biological opinion, we discussed the problem of exotic species introductions and their effects on the woundfin populations. The 1978 opinion stated, "Because the post-project conditions . . . will reduce base flows and cause the Virgin River to become more intermittent, we believe exotic species, such as green sunfish and redshiner, will become better established." We believe that this conclusion is still valid. Moreover, from biological collections this past summer, it is evident that the problem of exotic species competition is perhaps more widespread than before. Green sunfish, smallmouth bass, channel catfish, and redshiner were collected this past summer. During one of the biological collecting trips, we examined the stomach contents of a smallmouth bass, approximately 60 mm long, and found two juvenile woundfin averaging 25 mm.

Virgin River Chub

On August 23, 1980, the proposal to list the Virgin River chub as endangered was withdrawn because of procedural constraints of the Endangered Species Act. From recent biological sampling, it is evident that the chub has declined in numbers more than the other native species. Most of our concerns over the destruction of woundfin habitat also apply to the Virgin River chub. Moreover, the impact from the AWVES on the chub would be similar to those expressed for the woundfin.

We are not making specific flow recommendations for the Virgin River chub but the flows we have recommended for the woundfin would help sustain the chub at or near its present population levels. If the chub is listed in the future and sufficient data regarding habitat preferences are collected, we would be able to make specific recommendations of flow for this species using the same methodology as used for the woundfin.

Reduced Flows From Alton Coal Mining

OSM has informed us that pumping of groundwater for the Alton Coal Mine and for the coal slurry line could deplete the flow in the East Fork of the Virgin River by approximately 2 or 3 cfs after 40 years of pumping from aquifers. In our opinion, this level of depletion would not jeopardize continued existence of the woundfin. However, the depletion should be monitored carefully as soon as mining begins. If depletions become greater than OSM estimates, consultation should be reinitiated.

ALTERNATIVES

Section 7 of the ESA requires the consulting Federal agencies, in this case BLM and OSM, to insure that their actions do not jeopardize continued existence of a listed species. Section 7 also requires the FWS to recommend reasonable and prudent alternatives for any proposed project likely to cause jeopardy. Such alternatives are intended to eliminate the likelihood of jeopardy while allowing the consulting agency to achieve its objectives.

ALTERNATIVES DISCUSSED IN THE DRAFT EIS

It is the Warner Valley Water Project and not the rest of the AWVES that is likely to jeopardize the continued existence of the woundfin. The full need for this project also is questioned more than the need for the other components of the proposed AWVES. According to the draft EIS, it is doubtful that municipal and industrial water would be needed from the Warner Valley Reservoir before the year 2000 at the earliest. The recently completed Snow Canyon water project helps supply St. George. The planned Kolob Project is intended to supply other growing communities in the vicinity. No additional land would be irrigated from the Warner Valley Reservoir; more water would be applied to lands already being irrigated.

The draft EIS also reported that the need for the Warner Valley Powerplant is questionable. The staff of the California Public Utilities Commission recently reported to its Commission that the powerplant is not required for economic and electrical reliability reasons. If the powerplant is not constructed, then of course water for cooling the plant would not be extracted from the proposed reservoir.

The EIS discussed five alternatives to the applicants' proposal, four of which omit the Warner Valley Powerplant and Water Project. In the EIS summary, these four alternatives bear the following titles: (1) "Construct a 2,000-MW Powerplant at the Harry Allen Site and Slurry Coal from the Alton Coal Fields," (2) "Construct a 2,000-MW Powerplant at the Harry Allen Site with Coal Railed

from Wyoming or Central Utah," (3) "Energy Conservation and the Development of Alternative Energy Sources," and (4) "No Action." If one of these four alternatives is selected in lieu of the applicants' proposal, jeopardy to the woundfin would be avoided.

ALTERNATIVE OF A REDUCED OR MODIFIED WARNER VALLEY WATER PROJECT

BLM might determine that the Warner Valley Water Project is needed, perhaps because a powerplant is needed or because water is needed for municipal and industrial or irrigation purposes and cannot be supplied through other preferable means. If the quantity of water needed justifies construction and operation of a reservoir, this can be accomplished provided that the water remaining in the Virgin River is sufficient to meet the habitat requirements of the woundfin as we have described them previously in this report. Although the applicants' stated needs could not be met through this alternative, we believe their most critical needs could be. The applicants would have to choose whether to use the water for powerplant cooling, or for municipal, industrial, or agricultural use. Nonetheless, it appears their most important needs could be met by constructing and operating a smaller reservoir.

BLM and the project sponsors should also consider the feasibility of modifying the proposed Warner Valley Reservoir so that it could be operated for the betterment of the woundfin under certain conditions.

Woundfin habitat in the Virgin River below the Washington Fields Diversion is severely impacted during summers. Construction of a conduit from the Warner Valley Reservoir to the Virgin River could enable the return of water to the river for the benefit of the woundfin. This prospect could allow the improvement of woundfin habitat below Washington Fields diversion by storing high winter and spring flows and releasing them in summer low-flow periods.

In certain low-flow years, it may not be possible to maintain the flows that we recommend in Table 4 between the Hurricane Diversion and the Washington Fields Diversion. This is because the greatest available habitat for the woundfin occurs at 120 cfs from November through June and natural flow might be less than this volume. But construction of a conduit could provide the management capability to choose whether a given quantity of water would benefit the woundfin more by being left in the river during winter or spring or by being stored for release to the habitat below the Washington Fields Diversion Dam in the summer. Judgements may have to be made in advance based on meteorological and hydrological conditions.

It may be acceptable, under certain water conditions (and forecasted conditions), to slightly lower the flows in the river above the Washington Fields Diversion as long as the flows below this diversion are increased to benefit the woundfin in the reach below.

Another means of providing water to the Virgin River below the Washington Fields Diversion is worthy of consideration. Instead of releasing reservoir water to provide beneficial flows below this diversion structure, the volume of water diverted at this point to the Washington Fields farmland simply could be decreased, allowing more to pass downstream.

If significant new information is discovered that was not considered during this consultation, Section 7 consultation must be reinitiated. Also, BLM should not commit resources irreversibly before informing FWS how jeopardy will be avoided because such action could foreclose one or more of the alternatives discussed above. We ask BLM to report to us in writing the alternative selected so that further consultation can be arranged if needed.

We appreciate your interest in conserving the woundfin. Please let us know if we can assist you further.

Robert H. Shields

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
AREA OFFICE COLORADO-UTAH
1311 FEDERAL BUILDING
125 SOUTH STATE STREET
SALT LAKE CITY, UTAH 84128

IN REPLY REFER TO

(ES)

September 12, 1980

MEMORANDUM

TO: State Director
Bureau of Land Management
Salt Lake City, Utah

FROM: Area Manager
Fish and Wildlife Service
Salt Lake City, UT

SUBJECT: Allen-Warner Valley Energy System, Utah, Arizona, Nevada,
and California

In a memorandum dated March 5, 1980, you requested consultation with us and our recommendations regarding the Warner Valley water project, consistent with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.). Accordingly, as discussed with Mr. Don Cain of your staff, we have prepared a Technical Assistance Report.

In order to properly evaluate the project's potential impacts on fish and wildlife resources, we have included the other components of the Allen-Warner Valley Energy System as well. Although the reservoir project may be developed by itself to provide supplemental irrigation and domestic water locally, the primary purpose for project water is for cooling in the operation of the proposed Warner Valley power plant. In turn, evaluation of the water development related to power plant operation should include review of the related facilities and feasible alternatives.

This report will cover project-related coal mining activity only as it relates to the water development necessary for the coal slurry pipeline operation. Site specific evaluation of the coal leasing will be made during coordination with BLM and the Office of Surface Mining (OSM) pursuant to our Memoranda of Understanding with them.

Enclosure

Allen-Warner Valley Energy System
Utah, Arizona, Nevada, California

Fish and Wildlife Coordination Act
Technical Assistance Report

U.S. Fish and Wildlife Service
Salt Lake City, Utah

September 15, 1980

Description of the Proposed Project

To date, a specific project alternative for the Allen-Warner Valley Energy System has not been selected by the Bureau of Land Management (BLM) as a preferred alternative. Consequently, for the purpose of our evaluation, we will focus on the applicants' full development proposal and assume the "worst case" situation in our analysis of impacts on fish and wildlife resources.

The applicants, Nevada Power Company (NPC), Southern California Edison (SCE), the city of St. George, and the Washington County Water Conservancy District have proposed the development of a 2,500-megawatt (MW) coal-fired steam-electric generating system. The system, with a projected life of 40 years, would consist of a coal mine, a coal processing facility, a coal slurry pipeline system, two separate power plants, a water reservoir project, and an electrical transmission system (Figure 1).

The preferred source for coal would be the Alton coal field in southern Utah. Coal would be produced by both surface and underground methods. Dragline mining methods would be used to develop a 35-mile long coal outcrop through a contour strip mining operation. It is probable that underground mining would begin approximately 7 years after initiation of surface mining and would run concurrently. Other coal sources in central Utah and southwestern Wyoming are also being considered by the applicants as an alternative to the Alton deposit. The Alton mine would occupy about 8,328 acres of land.

The coal would be processed to form a slurry in a preparation plant located within the coal mine area. Water needs for preparation of the slurry are estimated to be approximately 9,700 acre-feet per year. The slurry would be pumped from the coal preparation plant in two separate buried steel pipelines to the two power plants. A 73-mile long, 12-inch diameter pipeline would deliver about 2 million tons of coal per year to the Warner Valley power plant, and a 183-mile long, 22-inch diameter pipeline would deliver about 9 million tons of coal per year to the Harry Allen power plant. Construction of the pipeline would involve a total of 2,218 acres.

The Warner Valley power plant, as proposed, would be located in Washington County, Utah, about 13 miles southeast of St. George. It would include two steam-turbine generating units, each designed to have an estimated net generating capacity of approximately 250 MW. The two smokestacks for the power plant would each be 500 feet high. A maximum rate of 8,090 tons of coal would be consumed daily. It is proposed that water for the power plant be provided by the proposed Warner Valley reservoir and the reclaimed water from the coal dewatering facilities within the plant site. An estimated 4,295 acres of land would be required for the power plant and related facilities.

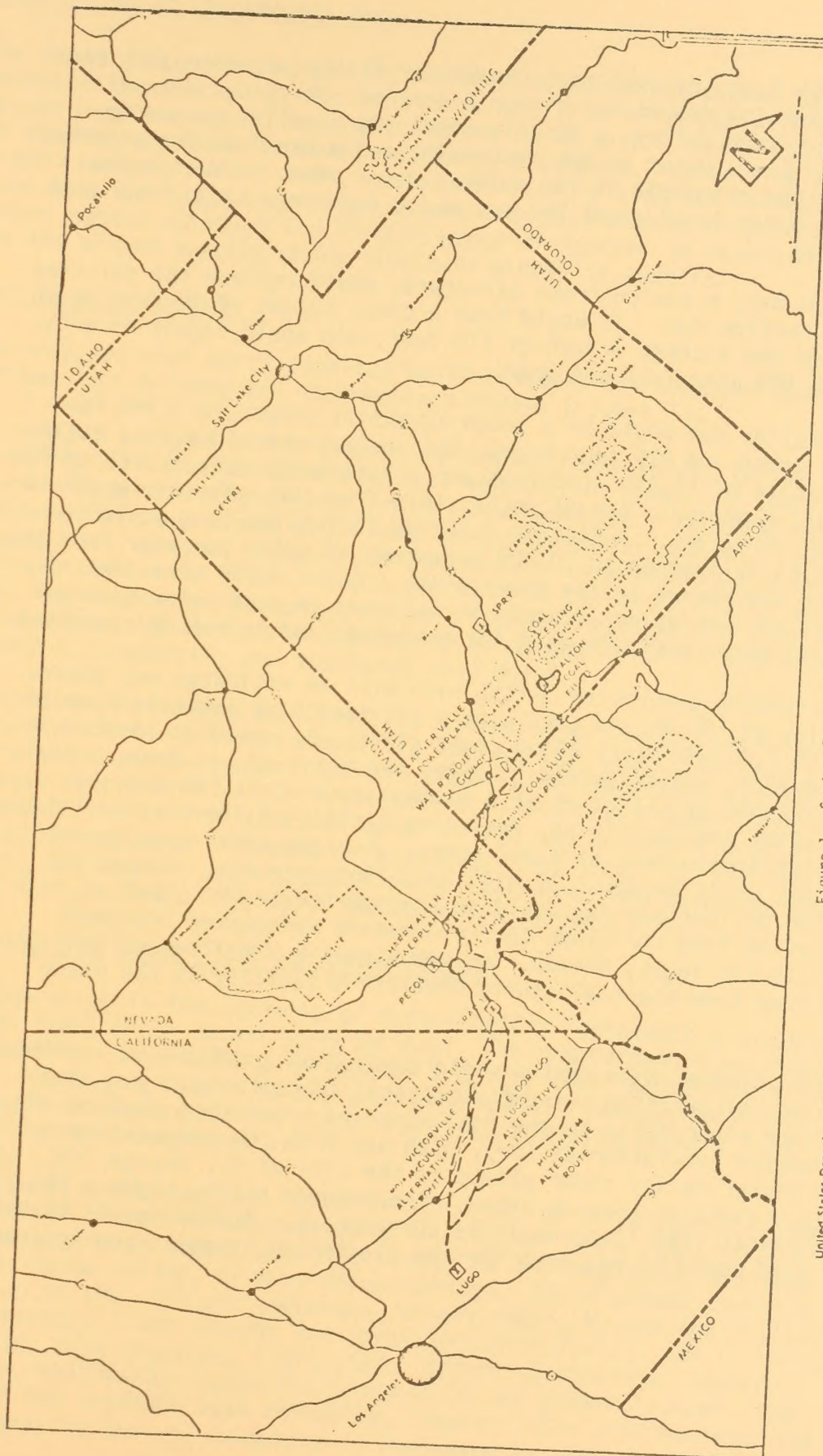


Figure 1. System Components, Allen-Warner Valley Energy System, Utah, Arizona, Nevada and California (taken from DEIS, BLM, 1980).

United States Department of the Interior
Bureau of Land Management

The applicants have proposed that the Warner Valley Water project consist of a diversion dam on the Virgin River, an off-stream dam and reservoir in Warner Valley, a 16-mile canal and pipeline system to convey Virgin River water to the reservoir, and a canal and/or pipeline network from the reservoir to the various water users in Washington County. The Water Development Project would require a total land area of 2,993 acres.

The diversion dam, a new concrete structure, would replace the existing Hurricane Diversion dam. It would have a crest height of 19 feet above the streambed and a crest length of 118 feet, and would result in withdrawal of 56,100 acre-feet per year.

The Warner Valley dam would be a zoned earthfill structure 3,340 feet long at the crest and 226 feet high. The reservoir would have a total storage capacity of 55,000 acre-feet and a reservoir surface area of 750 acres at full capacity. Annual water yield from the reservoir would be about 32,600 acre-feet. A 24-inch pipeline 11.2 miles long would be constructed to deliver up to 10,000 acre-feet of water per year from the reservoir to the Warner Valley power plant. About 8,000 acre-feet of supplemental irrigation water would be utilized in Washington County. The remaining water would be used for municipal and industrial purposes.

Four steam-turbine generating units, each with an estimated net generating capacity of 500 MW and each with a 575-foot high smokestack would comprise the 2,000-MW Harry Allen power plant. It would be located in Dry Lake, Nevada, approximately 25 miles northeast of Las Vegas. Coal would be consumed by the plant at a maximum rate of 31,248 tons per day. The power plant and facilities, including 6 miles of flood control dikes would require development of 5,887 acres. Average water requirements for the plant would be about 31 million gallons per day. An average 24.5 million gallons per day would be transported to the plant via buried pipeline from the Clark County Advanced Wastewater Treatment plant in East Las Vegas, Nevada. An additional 5.8 million gallons per day would come from the coal slurry dewatering facility at the plant site.

The proposed transmission system would consist of a network of overhead, high voltage, alternating current electrical transmission lines that would deliver electricity to the coal mine and processing plant at Alton from a proposed substation at Spry, Utah and from the proposed Harry Allen and Warner Valley power plants to the city of St. George, NPC, and California utilities' service areas. One hundred thirty eight-, 345-, and 500-kilovolt (kV) lines would be constructed. Approximately 13,954 acres of land could be required for the electrical transmission system.

Description of the project area

The areas of southwestern Utah, southern Nevada and southern California potentially affected by the project generally are located within the Mojave Desert region. Vegetation types found within these areas consist of blackbrush, creosote bush, saltbush, sagebrush, Joshua tree woodland, pinyon-juniper, desert wash, grass, riparian, playa, and various desert sand dune species. Generally, shrubs are the dominant component of the desert system although the largest group of species in desert communities are the winter annuals which fluctuate widely in numbers.

Coal slurry pipeline

The proposed coal surry pipeline would traverse southwestern Utah, northwestern Arizona and southeastern Nevada (Figure 1).

The eastern portion of the proposed pipeline route (Alton Valley to Hurricane Cliffs) lies within several vegetative types. In the higher elevations principally pinyon-juniper woodlands occur interspersed with deciduous oaks and areas which have been cleared for pasture. In the canyons, oak, pinyon-juniper, and ponderosa pine woodlands are the dominant vegetative types. South and west of the White Cliffs area in Utah, the vegetative community is more characteristically a combination of Great Basin desert scrub and desert grassland which is dominated by shadscale, sagebrush, and scattered sand dunes.

The area west of Hurricane Cliffs is dominated by the creosote bush community. Other biotic communities include the salt bush, desert riparian and stream communities associated with the Virgin and Muddy rivers. Fort Pierce Wash, in the Warner Valley area, supports a desert riparian flora with thickets of water willow and arrowweed growing closest to the water. Stands of salt cedar and desert willow line the washes, and in drier areas rabbitbrush, snakeweed, and sandsage grow along wash bottoms. The major ground cover is heronsbill.

Warner Valley Power Plant and Water Project

The vegetation in the vicinity of Warner Valley represents a mixture from at least three desert associations. The vegetation of southwestern Utah exhibits contributing influences from the Great Basin Desert to the north, the Mojave Desert to the southwest and the Painted Desert to the east. The influence of the three desert associations results in a transition desert community.

The primary vegetation type found in the areas of the proposed Warner Valley power plant and water project is creosote bush. The creosote occupies extensive areas, but also occurs in association with either galleta, range ratany, or more often bursage. Other shrubs commonly occurring in the area are snakeweed, desert thorn, Mormon tea, saltbush and winterfat. Some grasses and forbs including foxtail chess, Indian ricegrass, mesa dropseed, fluff grass, desert globemallow, flattop erigonum, whitemargin euphorbia, heronsbill and desert trumpet also occur in the creosote bush community. However, the area has been subject to overgrazing and the community is dominated by shrubs.

Riparian vegetation is found primarily along the Virgin River. Typical riparian species include shrubs such as willows, salt cedar, tamarisk, arrowweed and seepwillow. Rushes, sedges, watercress and cattails also may be present. The species composition and ground cover vary with the location and abundance of water and the condition of the vegetation also may vary with the extent of livestock use.

A 1974 publication, "Evaluation of Existing Wetland Habitat in Utah" (Utah State Division of Wildlife Resources Publication No. 74-17) indicates that only one identifiable wetland occurs within the Warner Valley area potentially affected by the proposed project. It is a 24-acre marsh of very dense cattails, bordered on one side by a strip of tamarisk and willows adjacent to the Virgin River. As such, it would be classified as a palustrine, persistent, emergent, cattail (*Typha* sp.) dominated wetland (PEPT) according to the 1979 Fish and Wildlife Service (FWS) "Classification of Wetlands and Deepwater Habitats of the United States". The cattail stand is used for escape and nesting cover by Gambel's quail and cottontail rabbits. At the time it was surveyed it received only limited waterfowl use. The water supply for this area is standing surface water and is entirely dependent on surface runoff and irrigation return flows.

The Virgin River is subject to extreme fluctuations in flow, due in part, to the semi-desert climate of the area and the diversion of river flows for irrigation and generation of electricity. The river experiences both periods of flooding and extremely low flows. In southwestern Utah its banks are lined with tamarisk which provides nesting areas for the mourning dove and Gambel's quail.

Harry Allen Power Plant

The proposed Harry Allen power plant site is located on a dry lakebed in a relatively wide valley floor sloping up into two low but rugged mountain ranges (Dry Lake and Arrow Canyon Range), and to the west into the higher Las Vegas Range. The entire area is dissected by numerous desert washes that drain the surrounding ranges. In some areas the bajada is interrupted by low rocky knolls. Four plant communities are represented in the area of the Harry Allen power plant including creosote bush, blackbrush, saltbush and playa. The creosote bush community covers approximately 80 percent of the area within a 10-mile radius of the proposed plant site and is dominated by burro bush and creosote bush. Other widespread species in the community include little-leaved ratany, Nevada Mormon tea, desert mallow, Cooper lycium, Mojave yucca, and the perennial galleta grass. Two annuals, the desert trumpet, and Russian thistle are also prominent in the desert creosote bush community. In a study of the proposed power plant project area personnel from the Department of Biological Sciences at the University of Nevada, Las Vegas, evaluated the percent live perennial cover in the plant communities. In the creosote bush community a high percentage of the perennial cover at their sampling stations was dead shrub cover. However, the dead shrubs are quite valuable in providing cover for some small vertebrates and many ground dwelling arthropods that provide food for lizards and some rodents.

The salt bush community typically is found at lower elevations as an outer vegetation zone on playas. It usually occupies poorly drained soils with high salt content. Shadscale and wingscale are the principal saltbush species found around the Dry Lake playa. Additional species, which also are common in the creosote bush community, include desert mallow, Cooper lycium, little-leaved and inkweed. Live shrub cover usually is similar to that found in the creosote bush community. Under conditions of widespread drainage into the playa and increased soil water availability, shrub cover may be considerably higher than in adjacent plant communities.

In Dry Lake the playa with its higher soil salinity is basically devoid of measurable cover. What does exist consists of widely scattered and stunted salt bush and Russian thistle.

The proposed pipeline which would provide water to the Harry Allen power plant would cross the Las Vegas and Dry Lake valleys. Creosote bush is again the predominant vegetation type along the proposed pipeline route. Approximately 20.5 miles of the route would cross this vegetative type. Portions of the saltbush community occur along 1-3 miles of the proposed route. The desert riparian community occurs regularly along the proposed route. Most of the washes are small and the community generally is not well-developed. Desert shrubs common along the smaller washes include cheeseweed, snakeweed, bladdersage and golden weed. Larger washes may support trees such as mesquite, catclaw, salt cedar, and desert willow. Approximately two miles of the proposed export pipeline would cross through cultivated alfalfa fields.

Electrical Transmission System

The proposed transmission line system would cross four major vegetation zones, the creosote bush, saltbush, sagebrush and pinyon-juniper. The creosote bush zone occurs below 4,000 feet mean sea level (msl) in southwestern Utah and southern Nevada. The dominant shrub, creosote bush, occurs in extensive, often almost pure stands on broad alluvial fans and flats where some underground water is available. As mentioned previously, it often occurs in association with other shrubs such as bursage, hopsage and desert thorn. The Joshua tree grows in open groves at the upper limit of this zone. Joshua tree is a species specific to the Mojave Desert, usually found on well-drained alluvial soils. Yucca is prevalent throughout the length of the transmission line corridor. In the Arizona and Utah portions of the route, datil yucca and fineleaf yucca are found; in the southern tip of Nevada, Mojave yucca is very common.

Cacti also form a highly visible component of the vegetation. Several species of a cane cholla occur in the area, including strawberry cholla at higher elevations and buckhorn cholla at lower elevations. Beaver tail is the most prevalent prickly pear, occurring everywhere except at higher elevations. Barrel cactus appears in the Beaver Dam Mountains

and along the Nevada portion of the route. Desert riparian vegetation grows along washes in the route area. Thickets of arrowweed and water willow are found alongside tree components such as desert willow, honey mesquite and salt cedar.

Blackbrush begins to come into the vegetation association at the upper limits of the creosote bush zone as a transitional community between the creosote bush and saltbush zones, and also between the Mojave and Great Basin deserts. Other desert shrubs associated with blackbrush are bursage, desert thorn, hopsage, rabbitbrush and snakeweed.

The saltbush zone occurs between 4,000 and 5,000 feet msl in the area. In the Utah-Arizona portion of the transmission line corridor four-winged saltbush is common to abundant. It is often associated with shadscale, winterfat or sand sage. Saltbush and sandsage tend to occur on sandy soil. Grass species occurring in the saltbush zone are most often galleta and foxtail chess. An annual forb, heronsbill, occurs over extensive areas as a ground cover species in the understory.

The sagebrush zone occurs at elevations above 5,000 feet msl. Big sage, characteristic of the Great Basin desert, is the dominant shrub, extending into the pinyon-juniper zone at higher elevations as the dominant understory shrub. Another sage species, sand sage, is locally dominant in areas of sandy soil. Other shrubs commonly found growing in the sagebrush association are cliffrose, bitterbrush and snakeweed. Common grass species are galleta and cheatgrass brome. Cheatgrass brome is a higher elevation species (5,500-7,500 feet msl) found infrequently in undisturbed big sage and pinyon-juniper communities. It is a species which is occurring on disturbed sites or sites of local soil disturbance such as in the vicinity of rodent burrows.

The pinyon-juniper zone occurs at elevations above 6,000 feet msl in the region. Along the proposed transmission line route, this zone is found in Bull Dog Canyon of the Beaver Dam Mountains. Juniper is dominant at lower elevations in this zone. With increasing altitude single-leaf pinyon becomes more common. Sagebrush is usually the dominant shrub species. A mixture of plant species characteristic of lower zones occurs in the understory vegetation in Bull Dog Canyon. Blackbrush is a major understory shrub along with Mormon tea and cliffrose. Clumps of yucca and agave occur on the rocky slopes and isolated Joshua trees extend into the pinyon-juniper zone. Blue grama and cheatgrass brome are the grasses commonly occurring in the zone.

Fish and Wildlife Resources

The proposed project area supports a wide variety of wildlife species. The mule deer and desert bighorn sheep are the primary big game species present. Mule deer is the most common of these occurring primarily in the middle and upper elevation desert shrub and pinyon-juniper communities. These communities are found most commonly along the coal slurry pipeline and transmission line routes. Individuals may wander into the Warner Valley power plant and water project areas during winter months, but suitable habitat is scarce and no permanent populations are known to use the valley.

The desert bighorn sheep is found on sparsely vegetated mountain slopes in California and Nevada. Permanent, seasonal, and transient sheep range for the Nelson's bighorn sheep in California has been identified within proposed alternative corridors for the western transmission line portion of the electrical transmission system.

The most common carnivores in the proposed project area are the coyote, kit fox and striped skunk. Also present are the red fox, gray fox, ring-tailed cat, bobcat, mountain lion, long-tailed weasel and the badger. These species generally rely on rodents, reptiles, amphibians, birds, arthropods, and occasionally vegetation for food. These carnivores tend to cover relatively large areas while hunting for prey. Denning areas include rock outcroppings, smaller caves, and under-ledges along hogbacks and washes, all of which are found along the proposed transmission line and coal slurry pipeline routes. These species also are present in Warner Valley. In the area of the proposed Harry Allen power plant and along the proposed water export pipeline the coyote, kit fox, bobcat and badger are the most likely carnivore species to be found.

Throughout the proposed project area the kangaroo rat, white-footed mouse, pocket mouse, grasshopper mouse, desert woodrat, ground squirrel, blacktail jackrabbit and desert cottontail are the most common rodent and rabbit species. In the area of the Harry Allen power plant site and the water export pipeline the Audobon's cottontail occurs more commonly than the desert cottontail. The pocket gopher and beaver also have been observed in riparian areas.

Many species of bats also inhabit the proposed project area including the western pipistrelle, California myotis, Brazilian free-tail bat, big free-tailed bat, pallid bat and spotted bat.

Birds of the project area include species typical of the Mojave and Great Basin deserts and their associated desert riparian habitats. Breeding species include many passerine and game bird species. Two seed-eating passerine species are generally the dominant breeding species in the desert shrub communities, the house finch and the black-throated sparrow. Although much of the project area habitat is dominated by creosote bush, both species prefer other plants in which to construct their nests. Other common breeding species include the ash-throated flycatcher, western kingbird, Say's phoebe, horned lark, mockingbird, and loggerhead shrike, all of which except the horned lark, which has a varied diet are insectivorous species. These breeding birds of desert shrub communities concentrate in dry wash or arroyo areas. Several other species are associated with Joshua tree habitats, including the ladder-backed woodpecker, cactus wren, and Scott's oriole.

Species breeding in riparian and adjacent cliff habitats are found principally along Fort Pierce Wash, Beaver Dam Creek, the Virgin and Muddy rivers, and Las Vegas Wash. Common breeding species in the area are killdeer, spotted sandpiper, roadrunner, belted kingfisher, western kingbird, willow flycatcher, black phoebe, Say's phoebe, violet-green swallow, verdin, and rock wren.

Species breeding in the pinyon-juniper habitat include the broad-tailed hummingbird, gray flycatcher, scrub jay, pinyon jay, bushtit, rufous-sided towhee, and chipping sparrow.

Altitudinal variation from approximately 1,800 feet to 5,000 feet msl, accounts for much diversity in vegetation which provides habitat for a variety of game species, including native and introduced upland birds and waterfowl. Among the upland game birds inhabiting the region are the chukar partridge, ring-necked pheasant, wild turkey, sage grouse, Gambel's quail, mourning dove, and band-tailed pigeon.

The chukar partridge is an exotic species introduced to Washington County, Utah. Its distribution is generally restricted to higher elevations, namely in the Beaver Dam Mountains. Its present status is unclear, and chukar are now found only in the Pine Valley Mountains.

Ring-necked pheasants have been recorded with consistency in Washington County since 1965, along the Virgin River and the Washington Fields. This species is dependent on irrigated lands which provide the soil moisture conducive to nesting success.

Sage grouse are rare in the area but have been reported from the Pine Valley area. Its preferred habitat consists of sagebrush at higher elevations. In the region, populations have been affected greatly by overgrazing. Wild turkey also may be present in this area.

One of the most common game birds in the proposed project area is the Gambel's quail. It is generally found near water, such as along the Virgin River bottom, adjacent to Fort Pierce Wash, Beaver Dam Wash, East Mormon Mountains, and Las Vegas Wash.

The mourning dove also is abundant throughout the area near washes, creeks, ponds, and rivers. Band-tailed pigeons inhabit mountainous areas of Washington and Clark counties, usually in ponderosa pine and oak regions.

Waterfowl use of the project area generally is limited to use of resting areas for migrating and wintering ducks and geese. At least 26 species of waterfowl are found in the area. The major species include the mallard, pintail, green-winged teal, blue-winged teal, cinnamon teal, American wigeon, shoveller, redhead, ring-necked duck, canvasback, and lesser scaup. The principal wintering and feeding areas include Washington Fields, the Virgin River, the Muddy River, Lake Mead National Recreation Area and Las Vegas Wash.

Winter resident species may spend as much as eight months of the year in the area, especially large numbers of passerine birds. Included in this group are the house wren, winter wren, ruby-crowned kinglet, water pipit, cedar waxwing, American goldfinch, dark-eyed juncos, and white-crowned sparrow.

Raptors also are quite numerous in the area during winter. It has been speculated that large wintering concentrations of some raptors can be attributed to the large number of passerines as prey, although the high level of winter rodent activity may account for some of the increase. The large numbers are primarily species from the north and from higher elevations, including the sharp-shinned hawk, Cooper's hawk, rough-legged hawk, peregrine falcon (a Federally listed endangered species), and American kestrel. A smaller portion may be permanent residents, including the red-tailed hawk, ferruginous hawk, marsh hawk, prairie falcon, turkey vulture, and golden eagle. Most of these wintering individuals are found in the riparian and agricultural areas near the Virgin and Muddy rivers and Las Vegas Wash.

Shorebirds also are found in large numbers in the agricultural and river area.

Reptiles utilize all habitats of the proposed project area. Twenty-three species of snakes, including five rattlesnakes, and nineteen species of lizards have been recorded in this area. The desert tortoise, the spiny softshell turtle, and the Gila monster have limited distributions within the region. The proposed locations of the Harry Allen power plant site and the coal slurry pipeline and electrical transmission lines through the Beaver Dam Mountains coincide with known desert tortoise activity. The proposed water export pipeline and alternative corridors of the western transmission line segment of the electrical transmission system also may cross desert tortoise habitat. The Beaver Dam Slope population was listed a threatened species under the Endangered Species Act of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 et. seq.).

Common reptiles include the banded gecko, desert iguana, chuckwalla, zebra-tailed lizard, collared lizard, leopard lizard, desert spiny lizard, side-blotched lizard, desert- and short-horned lizards, the western whiptail, the coachwhip, and the sidewinder.

Five families of amphibians may be encountered where water is available, at least seasonally, including the salamanders, spadefoot toads, true toads, treefrogs, and true frogs. The principal areas inhabited by amphibians within the proposed project area are Fort Pierce Wash, Virgin River, Beaver Dam Wash, Muddy River, and Las Vegas Wash. Two abundant species are Woodhouse's toad and the redspotted toad.

The only fishery of significance within the proposed project area occurs in the Virgin River. Three species of rare and unique fishes, the woundfin, Virgin River roundtail chub, and the Virgin River spinedace, inhabit the river within the potential impact area of the proposed Warner Valley water project. The flannelmouth sucker and desert sucker also are native to the Virgin River.

The woundfin, an endangered species, occurs in the Virgin River from

Laverkin Springs, Utah downstream to Lake Mead, Nevada and in lower portions of LaVerkin Creek. The historical range of the woundfin also included the lower Gila River in Arizona. However clear water, stable conditions and competition from exotic fishes are considered to have led to the elimination of the species from the Gila River. The woundfin prefers swift shallow runs (average 0.42 meters per second (m/sec) with a bottom of shifting sand, gravel and mud, as compared to the roundtail chub which is associated with pools and deeper runs of moderate current (average 0.34 m/sec).

The spinedace is located primarily in tributary streams. However, it also occurs in the mainstem of the Virgin River near the mouths of the tributaries.

Below Washington Diversion, which acts as a barrier, several exotic species can be found which compete with and prey on these fish. Included are the channel catfish, smallmouth bass, green sunfish, rainbow trout, and redbreast shiner.

Impacts of the Proposed Development

The applicant's development proposal could result in the temporary and/or permanent alteration or destruction of approximately 37,680 acres of land. This figure could be less dependent upon which alternative corridor is chosen for the western transmission line segment of the electrical transmission system.

The acreage required for each project component and general comparison of present and proposed project use is shown in the following display:

<u>Component</u>	<u>Acres Affected</u>	<u>Present Land Use</u>	<u>Project Use</u>
Alton Coal Field	8,328	Range, wildlife	Surface and underground mining
Coal Preparation Plant	1,826*	Range, cropland	Heavy industrial
Warner Valley Power Plant	4,295	Range, recreation	Heavy industrial
Warner Valley Water Plant	2,993	Range, recreation	Reservoir
Harry Allen Power Plant	5,887	Recreation, wildlife	Heavy industrial
Coal Slurry Pipeline	2,218	Range, recreation, wildlife	No change on unfenced right-of-way (temporary impact during construction); 1,000 acres of maintained easement
Electrical Transmission System	13,954	Range, recreation, wildlife	No change on unfenced right-of-way (temporary impact during construction); 483 acres of maintained access roads

*Acreage also included in acres affected by Alton Coal Field.

Excluding the Alton Coal Field, a permanent or long-term loss of approximately 13,175 acres of wildlife habitat could be expected to occur with development of the proposed project. A summary of impacts of project component follows.

Coal Slurry Pipeline

Noticeable and long-term impacts to desert and semidesert regions are expected along the pipeline route as a result of vegetation removal. Although impacts would be reversible, botanical succession to dominant vegetation may take anywhere from 20 to more than 100 years to complete. Soil disturbance would result in establishment of invader species such as Russian thistle, desert mallow, desert marigolds and desert trumpet.

A temporary loss of approximately 2 acres of riparian habitat would result during construction across the Virgin River. With adequate water availability and seasonal nutrient supply, new vegetation should develop fairly readily.

Habitat losses will impact primarily rodent and reptile populations. The desert tortoise^{1/} is locally common along the proposed pipeline route in the Beaver Dam Mountains and in the area of Dry Lake. Potential disturbance of the tortoise and its habitat could occur during construction of the pipeline. Care during excavation in areas known to be inhabited by tortoise, as described in the draft EIS, should minimize this potential impact.

Alton Valley to Kanab Creek Canyon and the Beaver Dam Mountains provide mule deer winter range and fawning habitat. Although disturbance of individuals is possible during construction, no significant reductions in populations or irreparable damage to forage is expected.

Cliff and mountain areas in the general project area supporting suitable trees provide nesting habitat for several raptor species. Aerial reconnaissance of the proposed pipeline corridor by consultants to the applicant identified two red-tailed hawk nest sites along the right-of-way. Potential disturbance or nest abandonment is possible during the nesting season if construction crews work too close to the nest sites, particularly for an extended period of time.

Operation of the slurry pipeline would result in the pumping of 10,000 acre-feet of ground water per year from the Navajo Sandstone Formation. Hydrologic data developed by consultants to OSM estimate that as a result the East Fork of the Virgin River may be depleted by as much as 2.5 cubic feet per second (cfs) or about 1,800 acre-feet after 40 years of pumping. Of itself, this flow depletion is not expected to significantly impact the fishery or riparian habitat of the Virgin River.

It is anticipated by the applicant that a rupture in the proposed pipeline would cause a localized ecological impact. The maximum expected spillage would be 12 acre-feet of slurry at a location estimated between the Hurricane Cliffs and the Beaver Dam Mountains. Any other location along the pipeline would involve a smaller volume of spillage. Consultants to

^{1/} The Beaver Dam slope population of desert tortoise is listed as threatened. Those found in the Dry Lake area are not federally protected.

the applicants have determined that biological impacts of a slurry spillage would be limited on land. They indicate that a single application of a natural saline water (900-1,000 total dissolved solids) to the desert vegetation would not adversely affect plant growth. Coal is not known to be toxic to plants, nor is it likely to cause adverse soil conditions or retard recovery of vegetation. Of greater concern would be the potential affects of a pipeline break at a river crossing and the resultant reduction in downstream water quality.

Warner Valley Power Plant

The primary impact of development of the Warner Valley Power Plant would be removal of vegetation for site development and the associated habitat loss. This loss would primarily affect rodents, rabbits, reptiles, amphibians and some desert bird species inhabiting this part of the valley. Population reduction of these groups would reduce the food supply of raptors and carnivorous mammals to some extent. It is possible that the presence of such facilities and increased human activity could result in a reduction of raptor use in the surrounding area. Construction of ponds associated with the power plant could result in use of the area by waterfowl, shorebirds and Gambel's quail.

Warner Valley Water Project

As with the power plant, terrestrial habitat losses in the water project area would affect primarily rodents, rabbits, reptiles, amphibians and some bird species, primarily passerines. The most significant impacts resulting from development of this project component would be the depletion of Virgin River flows which would be diverted to the off-stream reservoir site.

As proposed this facility would store 55,000 acre-feet per year from the Virgin River. Reservoir water would be used for cooling (10,000 acre-feet), as supplemental irrigation (8,000 acre-feet), municipal and industrial (26,400 acre-feet), and the remainder (10,600 acre-feet) as a powerplant reserve and dead storage. The Washington County Conservancy District's updated diversion schedule would require water diverted from the Virgin River at a rate of up to 160 cfs, but would allow a flow of 70 cfs to bypass the diversion during the months of October to February, 90 cfs from March to June, and 80 cfs from July to September. Consistent with the Endangered Species Act of 1973 (ESA) this diversion proposal is being evaluated during a reinitiation of the Section 7 consultation related to potential project impacts on the woundfin. Specific impacts to the Virgin River fishery and recommendations to offset those impacts will be contained in the upcoming biological opinion.

Harry Allen Power Plant

Approximately 5,890 acres of existing wildlife habitat would be disturbed or replaced by construction of the power plant and facilities, including the water export pipeline. Habitat losses and direct wildlife losses would affect primarily rodent and reptile populations, including the

desert tortoise. It should be noted however that this population is not listed as threatened. It is possible that development of the proposed cooling water reservoir and raw water storage reservoir could attract some waterfowl and other waterbirds.

A secondary impact of development of the power plant would be a reduction of water flow through Las Vegas Wash, a particularly productive and unique riparian area of southern Nevada. The area supports extensive salt cedar thickets and cattail marshes, habitat types which are quite atypical for the Las Vegas area. Wildlife is diverse including fish, amphibians, turtles, furbearers (beaver and muskrat) and the largest total and breeding population of birds in southern Nevada. Reuse of water from the advanced wastewater treatment plant in Las Vegas for the Harry Allen Power Plant would require a reduction of discharges to the wash. Changes in downstream biotic communities also could result from the reduced flows.

Electrical Transmission System

The construction of new roads, pad and tower areas, disposal areas and construction camps would require the removal of native vegetation. In turn, wildlife habitat losses and direct mortality of individuals would be expected. Rodents, birds, reptiles and amphibians would be most subject to these adverse impacts. Some mortality to waterfowl, shorebirds and raptors resulting from collisions with transmission lines are also likely to occur. Increased access to areas along the proposed transmission line route would occur with development of new roads for construction and maintenance. Off-road vehicle use of the proposed corridors could become significant particularly in areas inhabited by the desert bighorn sheep. Frequent disturbance or direct harassment could result in stress reducing lamb survival and resistance to disease in individuals. Short-term negative effects on aquatic organisms could occur due to temporary increases in erosion resulting from construction activities near river crossings.

Endangered Species

Several endangered fish and wildlife species inhabiting the proposed project area have been identified previously in this report. Expected effects of the proposed Allen-Warner Valley Energy System have been addressed for these species and findings forwarded to BLM consistent with requirements of the Endangered Species Act of 1973, as amended.

A July 3, 1980, biological opinion and conference finding covered the dwarf bear poppy, Silver cholla cactus, purple-spined hedgehog cactus and the Beaver Dam Slope population of the desert tortoise, which was proposed for listing as an endangered species at that time. This tortoise population has in the interim been listed as a threatened species (September 3, 1980). The conference finding indicated that if the tortoise was listed there would be no need for BLM to request consultation for the proposed project. It stated that the same evaluation would be made during formal consultation as was done for the conference finding.

The opinion concluded that the proposed project was not likely to jeopardize the continued existence of the purple-spined hedgehog cactus and the Siler pincushion cactus, but was likely to jeopardize the continued existence of the dwarf bear poppy.

Section 7 of the ESA requires FWS to recommend reasonable and prudent alternatives for any proposed project likely to jeopardize continued existence of a listed species. Thereby jeopardy to the species would be avoided and an action to accomplish the proposed project objective could still be implemented.

Several alternatives were recommended by the biological opinion including: (1) protection of the White Dome and Warner Ridge populations of the poppy; (2) through propagation and transplantation, establishment of at least one new population of poppies in the wild or increase of the number of plants found on Bureau of Land Management (BLM) administered lands in the White Hills and at Boomer Hill; (3) selection of one of the alternatives described by the draft environmental statement which does not include the Warner Valley water project and power plant. These alternatives are discussed in detail in our biological opinion of July 31, 1980.

The conference finding determined that the continued existence of the Beaver Dam Slope desert tortoise population would likely not be jeopardized by development of the proposed project. It stated that "The proposed coal slurry pipeline would cross the Beaver Dam Slope along the border of the proposed critical habitat, but in an area that tortoise use only in spring and autumn, if at all. The terrain is steep, making tortoise movement into the area unlikely. BLM reports it is over 1 mile to the nearest winter den. The proposed transmission line would cross the southeast corner of the proposed critical habitat area. As with the slurry pipeline, the terrain is steep and over 1 mile lies between the planned route and the nearest den".

BLM initially requested formal consultation on the woundfin, Yuma clapper rail, the unarmed three-spined stickleback and the American peregrine falcon in an August 26, 1977 memorandum. A subsequent biological opinion dated April 3, 1978, determined that the Yuma clapper rail and the stickleback did not occur in the project area and that continued existence of the peregrine would not be jeopardized by project development.

It did conclude however, that the proposed Warner Valley water project would jeopardize the continued existence of the woundfin. The opinion included a recommendation of stream flows required to protect the woundfin from adverse project impacts and avoid jeopardy to the species. In late 1979, the Washington County Water Conservancy District submitted a redesigned diversion schedule which stimulated BLM to reinitiate consultation on the project to determine if the redesigned diversions would lessen impacts to the woundfin.

In preparation of the new opinion, FWS conducted a cooperative instream flow study utilizing our Instream Flow Group's Incremental methodology (IFG-2). Hydrologic, channel geometry, flow records, and biological requirements of the woundfin in it's adult, juvenile and fry-life stages will be used in our analysis. Based on this information, the updated opinion will access the proposed water project and determine appropriate measures for the protection of the woundfin.

Recommendations

Because a preferred alternative has not yet been selected by BLM and in light of several key decisions yet to be made by other agencies, our recommendations, particularly those related to mitigation, will be quite general. At such time as a preferred development proposal is chosen, we anticipate further consultation with your agency in accordance with the Fish and Wildlife Coordination Act and development of supplemental reports as necessary. Such reports will include appropriate site specific mitigation recommendations.

In review of the available information we have not identified any specific project alternative that we would recommend at this time. Alternative 5 (energy conservation and the development of alternative energy sources) and 6 (no action) would have the least impact on fish and wildlife resources. Development of other alternatives could be acceptable with certain constraints consistent with requirements for protection of threatened or endangered species and mitigation for other resident fish and wildlife.

The most significant potential impact on fish and wildlife resources from the proposed development is the potential threat to continued existence of the woundfin resulting from depletion of Virgin River flows. Quantification of these impacts and recommended measures to eliminate such impacts will be contained in the FWS's forthcoming Section 7 biological opinion. Any alternative which provides for adequate mitigation of terrestrial and aquatic impacts could be acceptable to FWS.

An adequate mitigation plan for whichever development alternative is implemented should be developed jointly among the FWS, the affected state fish and wildlife agencies, BLM and the applicant. To offset adverse project impacts on fish and wildlife resources, we will be primarily interested in management of public lands adjacent to project facilities for the benefit of fish and wildlife resources.

Such a plan should include the following items:

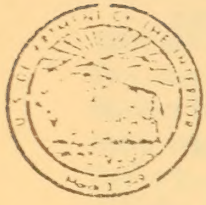
1. Provisions for management of the Warner Valley water project for waterfowl use, including diking to create a subimpoundment of the reservoir and vegetation management to provide suitable food and cover. If a Warner Valley water project is approved, FWS will make detailed recommendations as stipulative to issuance of a 404 permit.
2. No development of a fishery in the Warner Valley Reservoir to prevent introduction of exotic fish species into the Virgin River above Washington Diversion. This action would prevent possible adverse effects on the woundfin resulting from competition with exotics stocked in the reservoir.

3. Development of "guzzlers" in appropriate areas to improve existing and potential habitat for the Gambel's quail and other wildlife species.
4. Scheduling of construction of the coal slurry pipeline and electrical transmission lines to reduce adverse impacts on critical wildlife areas including winter range, calving, fawning and lambing areas, grouse strutting, breeding and brood rearing areas, routes and raptor breeding and brood rearing habitat. State fish and wildlife agencies should be consulted for recommendations of acceptable time periods to avoid adverse construction impacts. A lead time of 90 days should be observed in these contacts.
5. Establishment of monitoring stations in the emission fallout areas of the power plants to monitor possible toxic trace element accumulation in the soil, vegetation, water, aquatic invertebrates and aquatic vertebrates.
6. Establishment of native vegetative cover on all disturbed areas along the transmission line route and other project component areas not needed for project facilities.
7. Routing of the coal slurry pipeline and electrical transmission lines to avoid the endangered dwarf bear poppy, especially in the area where the slurry line passes Beehive Dome.

We appreciate the opportunity to provide these initial comments and look forward to further coordination on the proposed Allen-Warner Valley Energy System.

Biological Opinion on Three
Listed Plants, and a Conference
Report on Proposed Desert Tortoise

United States Department of the Interior
FISH AND WILDLIFE SERVICE



IN REPLY REFER TO:

FA/SE/BLM--Allen-Warner
Valley (6-5-77-F-18)

MAILING ADDRESS:
Post Office Box 25486
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Denver, Colorado 80225

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134 Union Blvd.
Lakewood, Colorado 80228

JUL 31 1980

MEMORANDUM

TO: State Director
Bureau of Land Management, Salt Lake City, Utah

FROM: Regional Director, Region 6
U.S. Fish and Wildlife Service, Denver, Colorado

SUBJECT: Allen-Warner Valley Energy System: Biological
Opinion on Three Listed Plants, Conference Report
on Proposed Desert Tortoise

This biological opinion was prepared pursuant to Section 7 of the Endangered Species Act (ESA), as amended, and in reply to your memorandum of December 28, 1979. The opinion addresses expected effects of the proposed Allen-Warner Valley Energy System (AKVES) in Utah on three listed plants: dwarf bear poppy (Arctomecon humilis), Siler pincushion cactus (Pediocactus sileri), and purple-spined hedgehog cactus (Echinocereus engelmannii var. purpureus).

With this biological opinion is a Fish and Wildlife Service (FWS) conference finding on the Beaver Dam Slope population of the desert tortoise (Gopherus agassizii). This population is proposed for listing as an endangered species, and the ESA requires FWS and Federal agencies such as the Bureau of Land Management (BLM) to confer on projects which could affect proposed species. The purpose of conferring on proposed species is to identify and avoid or reduce potential impacts on species that may become listed, and to do this at an early point in the development of a project.

As FWS and BLM agreed, a separate biological opinion will be issued for the woundfin, an endangered minnow in the Virgin River, on or before September 15, 1980. That opinion also may address the Virgin River roundtail chub depending on whether this species is listed or is removed from consideration for listing by the time the biological opinion is issued. One action or the other will be accomplished by August 23, 1980. The ESA allows 2 years from the time a species is proposed for listing until it must be listed; otherwise, it is to be removed from

consideration for listing (unless significant new information is obtained). It was August 23, 1978, that the roundtail was proposed for listing; thus, the 2 years allowed for listing will lapse late this August.

BIOLOGICAL OPINION

The proposed project is not likely to jeopardize continued existence of the purple-spined hedgehog cactus and the Silver cholla cactus, but it is likely to jeopardize continued existence of the dwarf bear poppy. Critical habitat has not been designated for any of these species.

CONFERENCE FINDING

The proposed project is not likely to jeopardize continued existence of the Beaver Dam Slope population of the desert tortoise. This population is proposed for listing as endangered and an area of 35 square miles within the Beaver Dam Mountains is proposed for designation as critical habitat.

PROJECT DESCRIPTION

The BLM described the purpose of the proposed AWVES in the draft environmental impact statement (EIS) issued June 1980. BLM stated the purpose is to meet the base load energy needs of Nevada Power Company, Southern California Edison, Pacific Gas and Electric, and the City of St. George, Utah. BLM rights-of-way permits are needed to allow use of public land. Under the project sponsors' proposal, the AWVES would consist of a coal field in south-central Utah; a 500-megawatt generating station near St. George, Utah; a 2,000-megawatt generating station near Las Vegas; coal slurry pipelines to run from the coal field to the two powerplants; and an electric transmission system. Also, a water development project is planned to provide water to the generating station near Las Vegas and a second water project (of more concern in this biological opinion) is planned in conjunction with the generating station at St. George. The latter water project would include a diversion dam on the Virgin River, an off-stream dam and reservoir in Warner Valley, and a system of canal pipelines. According to the Washington County Water Conservancy District, the major purpose for the Warner Valley Water Project is to provide water for several southern Utah communities, and a secondary purpose is to provide cooling water to the Warner Valley powerplant.

In sum, the AWVES is composed of two major parts: the Harry Allen Project and the Warner Valley Project. A coal mining operation would be part of both projects as both would depend on coal.

BLM has discussed alternatives to the sponsors' proposal in the draft EIS. It is the sponsors' proposal that is primarily discussed in this memorandum. We considered the alternatives discussed in the EIS in the context of whether their implementation would lessen impacts to the four species discussed herein.

BASIS OF OPINION AND CONFERENCE FINDING

JEOPARDIZED SPECIES

The dwarf bear poppy was listed as endangered on November 8, 1979. Occurring within the Colorado Plateau salt desert shrub biotic community, this plant is endemic to Moenkopi soil formations of the Virgin River Valley. Three population centers are known to exist and all occur within a 6-mile radius of St. George: the foothills around Bloomington, the Price City Hills, and the base of Warner Ridge. Of the three centers, only the Warner Ridge area occurs on Federal land. Some of the poppy's habitat is in private ownership, but most is owned by the State of Utah.

The rapid growth of St. George probably is the biggest threat to the bear poppy. Because of its showy white flowers, this plant has horticultural value and is susceptible to collection. Off-road vehicles (ORV's) are driven on or near all the areas where it is known to grow. Mining exploration is a threat because of surface disturbance.

The approximately 3,000 plants occurring on the west base of Warner Ridge are threatened by impacts from the Warner Valley Water Project and Powerplant. Human activity is expected to increase near the reservoir; therefore, ORV use could increase and more poppies could be collected. Also, construction of the coal slurry pipeline threatens the plant where the line is proposed to cross Beehive Dome and pass through Curly Hollow Wash.

The east slope of Warner Ridge is one of the landforms which creates the perimeter of the reservoir site, and it is possible that water could seep through Warner Ridge to the west, thereby adversely altering the environment for the poppy. Page 4-33 of the draft EIS discusses this problem and quotes a 1977 Bingham Engineering report. Water could move through the Shinarump member of the Chinle Formation and appear on the surface of Warner Ridge. To determine whether water would diffuse through the ridge, the volume likely to diffuse, and the possible effects on the poppy would require detailed study. Consideration would have to be given to relative elevations of the poppy habitat and the reservoir surface level, hydraulic head, slope through sandstone, permeability of sandstone, and effect of increased moisture on the poppy. However, it is clear that potential exists for changing the dry site to a more moist, cool one.

NONJEOPARDIZED SPECIES

The Siler pincushion cactus was listed as endangered on October 26, 1979. This cactus occurs in northcentral and northwest Arizona and in southern Washington County, Utah. The plants are found exclusively on small outcrops of gypsiferous clay soils. Most populations are small, consisting of a dozen or so individuals occurring on Moenkopi formations from 4,600 to 5,000 feet elevation.

In a memorandum dated May 22, 1980, the BLM State Director for Arizona wrote to the Chief of the FWS Office of Endangered Species and suggested that the Siler pincushion cactus be removed from the list of threatened and endangered species. Attached to the memorandum was a report by BLM botanists presenting evidence that this cactus is more prevalent and less impacted than most botanists previously believed. The report states that current habitat consists of more than 50,000 acres in Arizona.

BLM's botanist in Cedar City, Utah, used the above report and data of his own in estimating there are approximately 2,000 acres of Siler cactus habitat in Utah and the individual plants may number over 15,000 on Federal land when both Arizona and Utah are considered.

The proposed disposal of solid wastes from the Warner Valley Powerplant would destroy from 80 to 100 individual Siler cactus plants scattered over 500 acres of Moenkopi foothills. Also, the coal slurry pipeline would impact Siler cactus in a few restricted areas. The loss of plants to the direct impacts of solid waste disposal and pipeline construction would be less than 1 percent of the population. Indirect impacts of the AWWES on Siler cactus would result from increased human activities such as riding of ORV's and collecting of plants for gardens.

The purple-spined hedgehog cactus, listed as endangered on October 11, 1979, is known only from one location north of St. George. Urban development has reduced available habitat and is becoming an increasingly serious threat to this cactus. Known range is outside of the areas affected by the AWWES thus this plant will not be impacted.

Thirty-five square miles of the Beaver Dam Mountains are proposed for designation as critical habitat for the desert tortoise, and the tortoise population in that area is proposed for listing as an endangered species. Under a 2-year limitation imposed by the ESA, this listing proposal will expire on August 23, 1980. By that date, FWS will either list the Beaver Dam Slope population or withdraw the proposal to list. In other words, by late August this population will have either full protection or no protection under the ESA. If the tortoise is listed, there will be no need for BLM to request consultation for the AWWES because we have the same evaluation for our conference finding reported herein, that we would make during a formal consultation.

The desert tortoise ranges from Sonora, Mexico, north through western Arizona, southeast California, and the southern tip of Nevada to the extreme southwest corner of Utah. Its range in Utah encompasses roughly 80 square miles of the southwest corner of Washington County west of the Beaver Dam Mountains. The tortoise is confined to approximately 50 miles within the Beaver Dam Slope Area.

An estimated 2000 tortoises may have inhabited the area at one time based on the 400 winter dens discovered on the Beaver Dam Slope. The current population of wild tortoises is estimated at 350.

The proposed coal slurry pipeline would cross the Beaver Dam Slope along the border of the proposed critical habitat, but in an area that tortoises use only in spring and autumn, if at all. The terrain is steep, making tortoise movement into the area unlikely. BLM reports it is over one mile to the nearest winter den.

The proposed electrical transmission line would cross the southeast corner of the proposed critical habitat area. As with the slurry pipeline, the terrain is steep and over one mile lies between the planned route and the nearest winter den.

ALTERNATIVES FOR THE JEOPARDIZED SPECIES

Section 7 of the ESA requires FWS to recommend reasonable and prudent alternatives for any proposed project likely to jeopardize continued existence of a listed species. The purpose is to avoid jeopardy to such species while allowing implementation of an action that would accomplish the objective desired by the consulting agency.

Section 7 requires the consulting Federal agency, in this case BLM, to insure that its actions will not jeopardize a listed species. To assist you in avoiding jeopardy, we are recommending several alternatives. We ask that you report to us, in writing, which alternative you select so that further consultation can be arranged, if needed.

WHITE DOME ALTERNATIVE

A healthy population of dwarf bear poppies occurs on land owned by the State of Utah on White Dome at the south end of the Price City Hills. This population is threatened by ORV's and by plant collectors. BLM could avoid jeopardy to the bear poppy by arranging to protect the White Dome population. Without an overt action by someone, it is a fair assumption the White Dome population would be decimated in 20 years.

The acreage to be protected on White Dome should be determined in part on the basis of the acreage occupied by the Warner Ridge population likely to be jeopardized by the project. Also, the number of poppies per acre (density) growing on both Warner Ridge and White Dome should be considered in determining the acreage that ought to be protected. To give an idea of the area expected to be needed, we estimate this figure to be 150 to 200 acres.

BLM could protect the White Dome population via purchase of the land, land exchange, conservation easement, or agreement with the State of Utah. Other suitable ways may exist. The protective arrangement should be for perpetuity unless other populations of poppies are found or established in the future. If this alternative is selected, the White Dome population area should be fenced to preclude damage by ORV's and plant collectors.

The Warner Ridge population of poppies also should be fenced to prevent damage by ORV's and plant collectors. Also, the area should be made unavailable for mineral exploration. It should be realized, however, that FWS does not believe these measures alone would necessarily insure the welfare of the bear poppy. People still may gain unauthorized access to the area and water seepage from the reservoir could be a problem. We make this recommendation of protecting the Warner Ridge population, however, because we cannot be certain that water seepage would destroy or seriously impair the habitat. It would not be prudent to rule out survival of this population if human activities can be controlled. Moreover, this approach would provide BLM with management options. If in the future, after a suitable test period, reservoir water does not seep through Warner Ridge, and if damage by humans can be prevented, BLM would not need to continue to protect the White Dome population.

MANAGEMENT ALTERNATIVE

This alternative features experimentation with propagation and transplantation combined with another Section 7 consultation when results of the experiments are known. The intent would be to establish at least one new population of poppies in the wild or to increase the number of plants found on BLM administered lands in the White Hills and at Boomer Hill. For this alternative to be successful, BLM must establish numerous plants in the wild on habitat already occupied by poppies or on land which appears to be suitable poppy habitat, but has no poppies present.

Section 7 requires insurance that Federal actions do not jeopardize the existence of listed species; thus, success of establishing and protecting new plants in the wild cannot be in doubt for this alternative to be considered a success. Fortunately several years should exist during which BLM can carry out experiments and monitor the results. Time is available because of the time needed for approval and construction of the Warner Valley Powerplant and Water Project. Also it may take several years before increased human activity or water seepage would seriously reduce the numbers of poppies on Warner Ridge.

It would be important, however, for BLM to continually monitor the Warner Ridge and White Dome populations for adverse impacts while trying to establish poppies elsewhere. If serious adverse effects occur at Warner Ridge before other poppies are securely established and reproducing, or if the establishment effort is not successful, it would be necessary instead for BLM to arrange to protect the poppies at White Dome (or implement one of the following alternatives). Also, the condition of the poppies and the habitat at White Dome is important if the first alternative discussed above is to remain viable.

As with the White Dome alternative, the Warner Ridge population of poppies should be fenced. Also, the area should be closed to ORV's and plant collectors, and withdrawn from mineral exploration. Protection of the Warner Ridge poppies should be thought of as an integral part of the effort to propagate or transplant poppies. The Warner Ridge population could provide plant materials for this effort.

As part of this alternative or the White Dome alternative above, the coal slurry pipeline and the electrical transmission lines should be routed to avoid poppies, especially in the area where the slurry line passes Beehive Dome.

ALTERNATIVES DISCUSSED IN THE DRAFT EIS

The draft EIS for the AWVES discussed five alternatives to the applicants' proposal, four of which omit the Warner Valley Powerplant and Water Project. In the EIS summary, those four alternatives bear the following titles: (1) "Construct a 2,000-MW Powerplant at the Harry Allen Site and Slurry Coal from the Alton Coal Fields," (2) "Construct a 2,000-MW Powerplant at the Harry Allen Site with Coal Railed from Wyoming or Central Utah," (3) "Energy Conservation and the Development of Alternative Energy Sources," and (4) "No Action." If one of these four alternatives is selected and carried out in lieu of the applicants' proposal, jeopardy to the bear poppy would be avoided because it is the Warner Water Project and, to a lesser extent the Warner Powerplant, that are likely to jeopardize the bear poppy. BLM's final EIS will recommend a preferred alternative which may or may not be the applicants' proposal.

We recognize the Warner Water Project could be constructed even if the Warner Powerplant is not. That possibility should be the subject of a separate Section 7 consultation if such a proposal is made in the future.

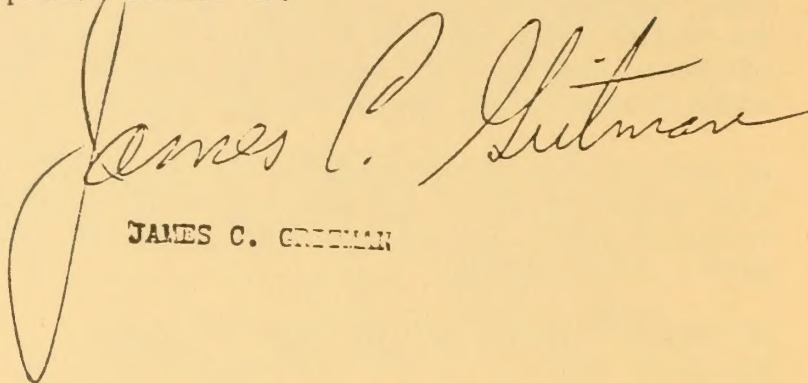
RECOMMENDATIONS FOR NONJEOPARDIZED SPECIES

No special protective measures are recommended for the Siler pincushion cactus because BLM has documented that project impacts would be light. BLM should monitor population trends, however, because the AWVES would reduce numbers of this species and threats are expected to increase as human populations increase in Utah and Arizona.

The coal slurry pipeline and the electrical transmission line proposed to cross the Beaver Dam Slope should be constructed when desert tortoises are in their winter dens. A wildlife biologist should survey the area to insure that winter dens are avoided as much as possible.

If new information is revealed that was not considered during this consultation, or a new species is listed in the project area, Section 7 consultation must be reinitiated. Moreover, BLM should not commit resources irreversibly before informing FWS how jeopardy will be avoided because such action could foreclose one or more of the alternatives discussed above.

We appreciate your strong interest in conserving imperiled species. If we can be of further assistance, please advise us.

A handwritten signature in cursive script, reading "James C. Gutman". The signature is written in dark ink and is positioned above the printed name. The first letter "J" is large and loops around the first part of the name. The last name "Gutman" is written in a fluid, connected style.

JAMES C. GUTMAN

APPENDIX 17

Socioeconomic Impact Projections

The tables in this appendix are organized by alternative (e.g., table number 3-4 shows impacts to law enforcement needs under Alternative 3). An overall listing of tables is provided for each alternative and is organized as follows:

Alternative 1

- 1-1 Impacts to Population
- 1-2 Impacts to Employment
- 1-3 Impacts to Incomes
- 1-4 Impacts to Law Enforcement Needs
- 1-5 Impacts to Fire Protection Needs
- 1-6 Impacts to Water Supply Needs
- 1-7 Impacts to Sewage Treatment Needs
- 1-8 Impacts to School Enrollments and Staffing Needs
- 1-9 Impacts to Health Care Facility Needs

Alternative 2

- 2-1 Impacts to Population
- 2-2 Impacts to Employment
- 2-3 Impacts to Incomes
- 2-4 Impacts to Law Enforcement Needs
- 2-5 Impacts to Fire Protection Needs
- 2-6 Impacts to Water Supply Needs
- 2-7 Impacts to Sewage Treatment Needs
- 2-8 Impacts to School Enrollments and Staffing Needs
- 2-9 Impacts to Health Care Facility Needs

Alternative 3

- 3-1 Impacts to Population
- 3-2 Impacts to Employment
- 3-3 Impacts to Incomes
- 3-4 Impacts to Law Enforcement Needs
- 3-5 Impacts to Fire Protection Needs
- 3-6 Impacts to Water Supply Needs
- 3-7 Impacts to Sewage Treatment Needs
- 3-8 Impacts to School Enrollments and Staffing Needs
- 3-9 Impacts to Health Care Facility Needs

Alternative 4

- 4-1 Impacts to Population
- 4-2 Impacts to Employment
- 4-3 Impacts to Incomes
- 4-4 Impacts to Law Enforcement Needs
- 4-5 Impacts to Fire Protection Needs
- 4-6 Impacts to Water Supply Needs
- 4-7 Impacts to Sewage Treatment Needs
- 4-8 Impacts to School Enrollments and Staffing Needs
- 4-9 Impacts to Health Care Facility Needs

TABLE 1-1
Impacts to Population

	1980			1985			1990			1995		
	Baseline Population Projection	Baseline Population Projection	Increment Due to Project	Baseline Population Projection	Baseline Population Projection	Increment Due to Project	Baseline Population Projection	Baseline Population Projection	Increment Due to Project	Baseline Population Projection	Baseline Population Projection	Increment Due to Project
Kane County	^a 3,929	5,040	7,706	2,666	5,938	9,297	6,662	10,536	3,359	6,662	10,536	3,874
Alton	75	50	206	156	59	255	67	293	196	67	293	226
Glendale	235	312	810	498	327	955	320	1,044	623	320	1,044	724
Kanab	2,095	2,908	4,299	1,391	3,426	5,178	3,844	5,865	1,752	3,844	5,865	2,021
Orderville	428	512	1,133	621	603	1,386	603	1,506	783	603	1,506	903
Washington County	^a 24,901	30,578	38,681	8,103	35,012	39,081	38,794	41,040	2,069	38,794	41,040	2,246
Hurricane	2,379	2,565	3,198	633	2,668	2,830	2,657	2,833	162	2,657	2,833	176
Ivins	594	599	774	175	739	784	892	940	45	892	940	48
Laverkin	1,167	1,272	1,571	299	1,485	1,561	1,676	1,759	76	1,676	1,759	83
Leeds	217	269	332	63	308	324	341	359	16	341	359	18
St. George	11,111	15,167	20,632	5,465	17,646	19,041	19,859	21,374	1,395	19,859	21,374	1,515
Santa Clara	1,063	1,040	1,393	353	1,218	1,308	1,377	1,475	90	1,377	1,475	98
Toquerville	282	266	337	71	305	323	388	408	18	388	408	20
Washington	2,218	2,413	3,461	1,048	2,612	2,860	3,061	3,351	268	3,061	3,351	290
Clark County												
Las Vegas	474,485	578,614	587,390	8,776	682,743	684,289	786,872	788,477	1,546	786,872	788,477	1,605
Valley			200									
Kane County		7,688	11,753	4,065								
Alton		77	314	237								
Glendale		316	1,075	759								
Kanab		4,436	6,557	2,121								
Orderville		611	1,558	947								
Washington County		43,177	45,517	2,340								
Hurricane		2,625	2,808	183								
Ivins		1,071	1,122	51								
Laverkin		1,900	1,986	86								
Leeds		380	398	18								
St. George		22,443	24,021	1,578								
Santa Clara		1,563	1,665	102								
Toquerville		376	397	21								
Washington		3,584	3,887	303								
Clark County												
Las Vegas		891,000	892,635	1,635								
Valley												

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
^aFigures will not sum to county totals because of outlying populations.

TABLE 1-2

Impacts to Employment

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
KANE COUNTY										
1980										
Baseline Without Project	168	0	75	84	46	281	28	281	253	1,216
1985										
Baseline Without Project	190	0	101	123	55	370	45	391	348	1,624
With the Project	190	510	264	123	122	470	57	507	442	2,686
Increment Due to Project	0	510	163	0	67	100	8	116	94	1,062
1990										
Baseline Without Project	197	0	116	162	70	442	46	466	431	1,933
With the Project	197	840	149	162	142	568	59	598	553	3,271
Increment Due to Project	0	840	33	0	72	126	13	132	122	1,338
1995										
Baseline Without Project	196	0	132	196	75	501	57	540	501	2,197
With the Project	196	1,015	172	196	150	654	75	707	654	3,818
Increment Due to Project	0	1,015	40	0	75	153	18	167	153	1,621
2000										
Baseline Without Project	203	0	155	242	88	586	67	641	598	2,575
With the Project	203	1,080	196	242	163	741	85	812	756	4,273
Increment Due to Project	0	1,080	41	0	75	155	18	171	158	1,698
WASHINGTON COUNTY										
1980										
Baseline Without Project	568	17	551	729	314	2,680	390	1,371	1,866	8,482
1985										
Baseline Without Project	582	20	642	973	361	3,089	481	1,695	2,176	10,028
With the Project	582	20	1,656	973	523	3,532	550	1,939	2,488	12,272
Increment Due to Project	0	0	1,014	0	162	443	69	244	312	2,244
1990										
Baseline Without Project	579	11	715	1,158	409	3,406	556	1,987	2,520	11,350
With the Project	579	11	749	1,158	543	3,564	582	2,081	2,650	11,921
Increment Due to Project	0	0	34	0	134	158	26	94	130	571
1995										
Baseline Without Project	560	12	772	1,358	436	3,662	635	2,242	2,765	12,455
With the Project	560	12	811	1,358	571	3,846	667	2,355	2,904	13,092
Increment Due to Project	0	0	39	0	135	184	32	113	139	637
2000										
Baseline Without Project	561	14	835	1,560	479	3,968	712	2,531	3,038	13,682
With the Project	561	14	875	1,560	615	4,185	746	2,652	3,183	14,348
Increment Due to Project	0	0	40	0	136	217	34	121	145	666

(continued)

TABLE 1-2 (concluded)

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
CLARK COUNTY										
1980										
Baseline Without Project	695	201	8,976	7,585	12,110	38,630	7,559	92,740	33,950	202,446
1985										
Baseline Without Project	729	235	11,250	10,270	15,310	51,070	10,150	120,100	41,690	260,804
With the Project	729	235	12,935	10,270	15,526	51,604	10,256	121,355	42,124	265,034
Increment Due to Project	0	0	1,685	0	216	534	106	1,255	434	4,230
1990										
Baseline Without Project	748	264	13,690	12,930	18,560	63,670	13,110	148,600	51,200	322,772
With the Project	748	264	13,709	12,930	18,806	63,761	13,129	148,813	51,273	323,427
Increment Due to Project	0	0	19	0	246	91	19	213	73	655
1995										
Baseline Without Project	777	296	16,019	15,607	21,777	76,163	15,824	176,340	59,530	382,333
With the Project	777	296	16,040	15,607	22,034	76,260	15,844	176,565	59,606	383,020
Increment Due to Project	0	0	21	0	257	97	20	225	76	687
2000										
Baseline Without Project	804	328	18,376	18,279	25,002	88,683	18,600	204,270	68,155	442,497
With the Project	804	328	18,398	18,279	25,250	88,785	18,622	204,506	68,234	443,184
Increment Due to Project	0	0	22	0	248	102	22	236	79	687

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980.
May not add due to round-off.

NOTE: Figures represent number of jobs.

TCU = transportation, communication, and utilities

FIRE = finance, insurance, and real estate

TABLE 1-3

Impacts to Incomes

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
KANE COUNTY										
<u>1980</u>										
Baseline Without Project	1.07	0	1.71	0.53	0.53	1.89	0.25	2.77	2.01	10.74
<u>1985</u>										
Baseline Without Project	1.34	0	2.43	0.85	0.69	2.73	0.43	4.27	3.04	15.81
With the Project	1.34	12.50	6.38	0.85	1.52	3.47	0.54	5.53	3.86	36.04
Increment Due to Project	0	12.50	3.95	0	0.83	0.74	0.09	1.26	0.82	20.23
<u>1990</u>										
Baseline Without Project	1.53	0	3.11	1.24	0.95	3.63	0.50	5.60	4.17	20.73
With the Project	1.53	22.73	3.99	1.24	1.94	4.66	0.63	7.19	5.35	49.25
Increment Due to Project	0	22.73	0.88	0	0.99	1.03	0.13	1.59	1.18	28.52
<u>1995</u>										
Baseline Without Project	1.67	0	3.91	1.64	1.15	4.54	0.65	7.17	5.35	26.08
With the Project	1.67	29.73	5.09	1.64	2.29	5.92	0.86	9.39	6.97	63.56
Increment Due to Project	0	29.73	1.18	0	1.14	1.38	0.21	2.22	1.62	37.48
<u>2000</u>										
Baseline Without Project	1.93	0	5.00	2.23	1.45	5.84	0.84	9.39	7.06	33.77
With the Project	1.93	34.93	6.34	2.23	2.73	7.39	1.07	10.97	8.92	76.54
Increment Due to Project	0	34.93	1.34	0	1.28	1.55	0.23	1.58	1.86	42.77
WASHINGTON COUNTY										
<u>1980</u>										
Baseline Without Project	13.94	0.28	7.61	8.25	5.96	21.10	4.04	13.94	16.51	91.72
<u>1985</u>										
Baseline Without Project	15.88	0.24	9.72	12.21	7.71	26.91	5.45	18.97	21.34	118.54
With the Project	15.88	0.24	25.06	12.21	11.14	30.76	6.23	21.70	24.40	147.74
Increment Due to Project	0	0	15.34	0	3.43	3.85	0.78	2.73	3.06	29.20
<u>1990</u>										
Baseline Without Project	17.49	0.29	11.90	16.02	9.41	32.77	7.05	24.54	27.19	146.97
With the Project	17.49	0.29	12.98	16.02	12.54	34.33	7.28	25.70	28.49	155.42
Increment Due to Project	0	0	1.08	0	3.13	1.56	0.23	1.16	1.30	8.45
<u>1995</u>										
Baseline Without Project	18.25	0.35	14.33	20.69	11.32	38.91	8.84	30.60	32.90	176.88
With the Project	18.25	0.35	15.89	20.69	14.80	40.86	9.16	32.14	34.50	186.53
Increment Due to Project	0	0	1.56	0	3.48	1.95	0.32	1.54	1.60	9.65
<u>2000</u>										
Baseline Without Project	20.48	0.43	17.07	26.24	13.65	46.30	10.88	37.98	40.11	231.35
With the Project	20.48	0.43	17.88	26.24	17.52	48.52	11.25	39.80	42.02	242.36
Increment Due to Project	0	0	0.81	0	3.87	2.22	0.37	1.82	1.92	11.01

(continued)

TABLE 1-3 (concluded)

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
CLARK COUNTY										
1980										
Baseline Without Project	16.37	3.22	182.13	125.43	234.22	412.88	107.31	1,246.70	411.44	2,739.31
1985										
Baseline Without Project	18.96	4.16	252.03	187.51	326.93	602.63	159.09	1,782.52	557.81	3,891.64
With the Project	18.96	4.16	289.74	187.51	331.56	608.94	160.77	1,801.15	563.65	3,966.43
Increment Due to Project	0	0	37.71	0	4.63	6.31	1.68	18.63	5.84	74.79
1990										
Baseline Without Project	21.48	5.16	338.62	260.64	441.26	829.49	226.84	2,435.11	756.38	5,314.99
With the Project	21.48	5.16	339.09	260.64	447.06	830.68	227.17	2,438.60	757.46	5,327.34
Increment Due to Project	0	0	0.47	0	5.80	1.19	0.33	3.49	0.08	12.35
1995										
Baseline Without Project	24.15	6.38	437.46	347.35	571.65	1,095.53	302.35	3,190.34	970.99	6,946.20
With the Project	24.15	6.38	438.04	347.35	578.10	1,096.95	302.75	3,194.50	972.27	6,960.49
Increment Due to Project	0	0	0.58	0	6.45	1.42	0.40	4.16	1.28	14.29
2000										
Baseline Without Project	28.14	7.81	554.61	449.17	724.61	1,408.37	392.37	4,080.29	1,227.34	8,872.71
With the Project	28.14	7.81	555.27	449.17	731.80	1,409.99	392.83	4,085.03	1,228.76	8,888.80
Increment Due to Project	0	0	0.66	0	7.19	1.62	0.46	4.74	1.42	16.09

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980.^aMay not add due to round-off.

NOTE: Figures represent millions of 1977 dollars.

TCU = transportation, communication, and utilities

FIRE = finance, insurance, and real estate

TABLE 1-4

Impacts to Law Enforcement Needs

	1980				1985				1990				1995			
	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project
Kane County																
Alton	a	a	a	0			a	0			a	0		a	a	0
Glendale	a	a	2	1			a	1			2	2		a	2	2
Kanab	4.5	6	8.5	2.5			7	2.5			10.5	3.5		8	12	4
Orderville	b	b	2.5	2			b				3	2.5		b	3	2.5
Washington County																
Hurricane	5	5.5	6.5	1			5.5	0.5			6	0.5		5.5	6	0.5
Ivins	1.5	1.5	2	0.5			1.5				2	0.5		2	2	0
LaVerkin	2.5	2.5	3.5	1			3	0.5			3.5	0.5		3.5	3.5	0
Leeds	b	b	1	0.5			b				1	0.5		b	1	0.5
St. George	19	26	35.5	9.5			30	9.5			32.5	2.5		34	36.5	2.5
Santa Clara	2.5	2.5	3	0.5			2.5				3	0.5		3	3	0
Toquerville	1	1	1	0			1	0			1	0		1	1	0
Washington	4.5	5	7	2			5.5				6	0.5		6.5	7	0.5
Clark County																
Las Vegas Valley	807	984	999	15			1,161				1,163	2		1,338	1,340	2
2000																
Kane County																
Alton	a	a	a	0												
Glendale	a	a	2	2												
Kanab	9	9	13	4												
Orderville	b	b	3.5	3												
Washington County																
Hurricane		5.5	6	0.5												
Ivins		2	2.5	0.5												
LaVerkin		4	4	0												
Leeds		b	1	0.5												
St. George		38.5	38.5	0												
Santa Clara		3.5	3.5	0												
Toquerville		1	1	0												
Washington		7.5	8	0.5												
Clark County																
Las Vegas Valley		1,515	1,517	2												

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

a One officer half time or less.

b One officer more than half time.

NOTE: Figures represent number of police officers.

TABLE 1-5

Impacts to Fire Protection Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County												
Alton	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Glendale	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Kanab	1,500-1,750	1,500-1,750	250-1,000	2,000-2,500	2,000-2,500	250-1,000	1,750-2,000	2,500-2,750	500-1,000	1,750-2,000	2,500-2,750	500-1,000
Orderville	500-1,000	500-1,000	0-750	1,000-1,250	1,000-1,250	0-750	500-1,000	1,250-1,500	250-1,000	500-1,000	1,250-1,500	250-1,000
Washington County												
Hurricane	1,500-1,750	1,500-1,750	0-500	1,750-2,000	1,750-2,000	0-500	1,500-1,750	1,750-2,000	0-500	1,500-1,750	1,750-2,000	0-500
Ivins	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Laverkin	1,000-1,250	1,000-1,250	0-500	1,250-1,500	1,250-1,500	0-500	1,000-1,250	1,250-1,500	0-500	1,250-1,500	1,500-1,750	0-500
Leeds	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
St. George	3,000-3,500	3,000-3,500	500-1,500	4,500-5,000	4,500-5,000	500-1,500	3,500-4,000	4,500-5,000	0-1,000	4,000-4,500	4,500-5,000	0-1,000
Santa Clara	1,000-1,250	1,000-1,250	250-500	1,250-1,500	1,250-1,500	250-500	1,000-1,250	1,250-1,500	0-500	1,000-1,250	1,250-1,500	0-500
Toquerville	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500	500-1,000	500-1,000	0-500
Washington	1,500-1,750	1,500-1,750	0-500	1,750-2,000	1,750-2,000	0-500	1,500-1,750	1,750-2,000	0-500	1,750-2,000	1,750-2,000	0-250
Clark County												
Las Vegas												
Valley	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	0-1,000
	2000											
Kane County												
Alton		500-1,000	0-500		500-1,000	0-500						
Glendale		500-1,000	0-500		1,000-1,500	0-500						
Kanab		2,000-2,250	500-1,000		2,750-3,000	500-1,000						
Orderville		500-1,000	250-1,000		1,250-1,500	250-1,000						
Washington County												
Hurricane		1,500-1,750	0-500		1,750-2,000	0-500						
Ivins		1,000-1,250	0-250		1,000-1,250	0-250						
Laverkin		1,250-1,500	0-500		1,500-1,750	0-500						
Leeds		500-1,000	0-500		500-1,000	0-500						
St. George		4,500-5,000	250-500		4,750-5,000	250-500						
Santa Clara		1,250-1,500	0-250		1,250-1,500	0-250						
Toquerville		500-1,000	0-500		500-1,000	0-500						
Washington		1,750-2,000	0-250		1,750-2,000	0-250						
Clark County												
Las Vegas												
Valley		11,000-12,000	0-1,000		11,000-12,000	0-1,000						

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
NOTE: Figures represent pumping capacity in gallons pumped per minute.

TABLE 1-6
Impacts to Water Supply Needs

	1980				1985				1990				1995			
	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County																
Alton	.034	.023	.093	.070	.027	.115	.088	.030	.132	.030	.132	.088	.030	.132	.088	.030
Glendale	.106	.140	.365	.225	.147	.470	.323	.144	.470	.144	.470	.323	.144	.470	.323	.144
Kanab	.943	1.309	1.935	.626	1.542	2.330	.788	1.730	2.639	1.730	2.639	.788	1.730	2.639	.788	1.730
Orderville	.193	.230	.510	.280	.271	.624	.353	.271	.624	.271	.624	.353	.271	.624	.353	.271
Washington County																
Hurricane	1.071	1.154	1.439	.285	1.201	1.274	.073	1.196	1.274	1.196	1.274	.073	1.196	1.274	.073	1.196
Ivins	.267	.270	.348	.078	.333	.353	.020	.401	.423	.401	.423	.020	.401	.423	.020	.401
LaVerkin	.525	.572	.707	.135	.668	.702	.034	.754	.792	.754	.792	.034	.754	.792	.034	.754
Leeds	.098	.121	.149	.028	.139	.146	.007	.153	.162	.153	.162	.007	.153	.162	.007	.153
St. George ^a	6.181	7.368	9.827	2.459	8.784	9.412	.628	10.473	11.155	10.473	11.155	.628	10.473	11.155	.628	10.473
Santa Clara	.478	.468	.627	.159	.568	.589	.041	.620	.664	.620	.664	.041	.620	.664	.041	.620
Toquerville	.128	.120	.152	.032	.137	.145	.008	.152	.184	.152	.184	.008	.152	.184	.008	.152
Washington	.990	1.086	1.557	.489	1.175	1.296	.121	1.377	1.508	1.377	1.508	.121	1.377	1.508	.121	1.377
Clark County																
Las Vegas Valley	213.518	260.376	264.326	3.949	307.234	307.930	.696	354.092	354.815	354.092	354.815	.696	354.092	354.815	.696	354.092
	2000															
Kane County																
Alton	.035	.141	.106	.06	.141	.106	.06	.141	.106	.141	.106	.06	.141	.106	.06	.141
Glendale	.142	.484	.342	.342	.484	.342	.342	.484	.342	.484	.342	.342	.484	.342	.342	.484
Kanab	1.996	2.951	.955	.955	2.951	.955	.955	2.951	.955	2.951	.955	.955	2.951	.955	.955	2.951
Orderville	.275	.701	.426	.426	.701	.426	.426	.701	.426	.701	.426	.426	.701	.426	.426	.701
Washington County																
Hurricane	1.181	1.264	.083	.083	1.264	.083	.083	1.264	.083	1.264	.083	.083	1.264	.083	.083	1.264
Ivins	.482	.505	.023	.023	.505	.023	.023	.505	.023	.505	.023	.023	.505	.023	.023	.505
LaVerkin	.855	.894	.039	.039	.894	.039	.039	.894	.039	.894	.039	.039	.894	.039	.039	.894
Leeds	.171	.179	.008	.008	.179	.008	.008	.179	.008	.179	.008	.008	.179	.008	.008	.179
St. George ^a	12.845	13.195	.350	.350	13.195	.350	.350	13.195	.350	13.195	.350	.350	13.195	.350	.350	13.195
Santa Clara	.703	.749	.046	.046	.749	.046	.046	.749	.046	.749	.046	.046	.749	.046	.046	.749
Toquerville	.169	.179	.010	.010	.179	.010	.010	.179	.010	.179	.010	.010	.179	.010	.010	.179
Washington	1.613	1.749	.136	.136	1.749	.136	.136	1.749	.136	1.749	.136	.136	1.749	.136	.136	1.749
Clark County																
Las Vegas Valley	400.950	401.686	.736	.736	401.686	.736	.736	401.686	.736	401.686	.736	.736	401.686	.736	.736	401.686

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
^aTotals for St. George include amounts for Bloomington with water supplied by St. George.
NOTE: All figures represent million gallons per day peak demand and are based upon a standard of 450 gallons per person per day (roughly equivalent to 1,600 gallons per day per hook-up with 3.5-4.0 persons per hook-up).

TABLE 1-7

Impacts to Sewage Treatment Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County												
Alton	.013	.008	.035			.027	.010	.043	.033	.011	.049	.038
Glendale and Orderville	.111	.138	.326			.188	.156	.393	.237	.155	.428	.273
Kanab	.352	.489	.722			.233	.576	.870	.294	.616	.985	.369
Washington County												
Hurricane, and LaVerkin, and Toquerville	.643	.689	.858			.169	.749	.792	.043	.785	.840	.055
Ivins	.100	.101	.130			.029	.124	.132	.008	.150	.158	.008
Leeds	.036	.045	.056			.011	.052	.054	.002	.057	.060	.003
St. George and Santa Clara	2.045	2.723	3.700			.977	3.169	3.419	.250	3.568	3.839	.271
Washington	.373	.405	.581			.176	.439	.484	.045	.514	.563	.049
Clark County												
Las Vegas Valley	79.713	97.207	98.682			1.474	114.701	114.961	.260	132.194	132.464	.270
			2000									
Kane County												
Alton		.013	.053			.040						
Glendale and Orderville		.156	.442			.286						
Kanab		.715	1.102			.387						
Washington County												
Hurricane, and LaVerkin, and Toquerville		.823	.872			.049						
Ivins		.180	.188			.008						
Leeds		.064	.067			.003						
St. George and Santa Clara		4.033	4.315			.282						
Washington		.602	.653			.051						
Clark County												
Las Vegas Valley		149.688	149.963			.275						

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: All figures represent million gallons per day effluent and are based upon a standard of 168 gallons effluent per day per person.

TABLE 1-8
Impacts to School Enrollments and Staffing Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Increment Due to Project	
Kane County Enrollments Staffing ^a	933 40 b (54)	1,260 50	1,927 84	667 34	1,485 59	2,325 102	840 43	1,666 67	2,634 116	968 49		
Washington County Enrollments Staffing ^a	6,300 252 b (260)	7,981 319	10,096 402	2,115 83	9,138 366	9,678 387	540 21	10,125 405	10,712 428	587 23		
Clark County Enrollment Staffing ^a	94,495 4,534	115,232 5,524	117,049 5,611	1,817 87	135,970 6,524	136,290 6,539	320 15	156,708 7,520	157,040 7,536	332 16		
2000												
Kane County Enrollment Staffing ^a		1,922 77	2,938 129	1,016 52								
Washington County Enrollment Staffing ^a		11,269 451	11,880 475	611 24								
Clark County Enrollment Staffing ^a		177,445 8,515	177,783 8,531	338 16								

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aStaffing requirements based upon a maximum student/teacher ratio of 25:1.

^bFigures in parentheses represent existing (1980) staffing levels.

TABLE 1-9
Impacts to Health Care Facility Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County Hospital Nursing Home	6 23	7 26	11 35	4 9	14 40	5 11	9 29	10 32	15 44	10 32	15 44	5 8
Washington County Hospital Nursing Home	63 223	77 272	97 341	20 69	98 344	10 35	88 309	98 342	103 361	98 342	103 361	5 19
Clark County Hospital Nursing Home	1,252 978	1,528 1,190	1,552 1,209	24 19	1,807 1,406	4 3	1,803 1,403	2,087 1,615	2,092 1,618	2,087 1,615	2,092 1,618	5 3
2000												
Kane County Hospital Nursing Home		11 35	17 48	6 13								
Washington County Hospital Nursing Home		109 379	114 399	5 20								
Clark County Hospital Nursing Home		2,352 1,827	2,357 1,831	5 4								

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
NOTE: Figures represent number of bed spaces.

TABLE 2-1
Impacts to Population

	1980			1985			1990			1990		
	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection
Kane County	3,929	5,040	7,706	2,666	2,666	5,938	9,297	3,359	10,536	6,662	10,536	3,874
Alton	75	50	206	156	156	59	255	196	293	67	293	226
Glendale	235	312	810	498	498	327	955	628	1,044	320	1,044	724
Kanab	2,095	2,908	4,299	1,391	1,391	3,426	5,178	1,752	5,865	3,844	5,865	2,021
Orderville	428	512	1,133	621	621	603	1,386	783	1,506	603	1,506	903
Clark County												
Las Vegas	474,485	578,614	587,390	8,776	8,776	682,743	684,289	1,546	788,477	786,872	788,477	1,605
Valley			2000									
Kane County												
Alton		7,688	11,753	4,065	4,065							
Glendale		77	314	237	237							
Kanab		316	1,075	759	759							
Orderville		4,436	6,557	2,121	2,121							
		611	1,558	947	947							
Clark County												
Las Vegas		891,000	892,635	1,635	1,635							
Valley												

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aFigures will not sum to county totals because of outlying populations.

TABLE 2-2

Impacts to Employment

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
KANE COUNTY										
1980										
Baseline Without Project	168	0	75	84	46	281	28	281	253	1,216
1985										
Baseline Without Project	190	0	101	123	55	370	45	391	348	1,624
With the Project	190	510	264	123	122	470	57	507	442	2,686
Increment Due to Project	0	510	163	0	67	100	8	116	94	1,062
1990										
Baseline Without Project	197	0	116	162	70	442	46	466	431	1,933
With the Project	197	840	149	162	142	568	59	598	553	3,271
Increment Due to Project	0	840	33	0	72	126	13	132	122	1,338
1995										
Baseline Without Project	196	0	132	196	75	501	57	540	501	2,197
With the Project	196	1,015	172	196	150	654	75	707	654	3,818
Increment Due to Project	0	1,015	40	0	75	153	18	167	153	1,621
2000										
Baseline Without Project	203	0	155	242	88	586	67	641	598	2,575
With the Project	203	1,080	196	242	163	741	85	812	756	4,273
Increment Due to Project	0	1,080	41	0	75	155	18	171	158	1,698
CLARK COUNTY										
1980										
Baseline Without Project	695	201	8,976	7,585	12,110	38,630	7,559	92,740	33,950	202,446
1985										
Baseline Without Project	729	235	11,250	10,270	15,310	51,070	10,150	120,100	41,690	260,804
With the Project	729	235	12,935	10,270	15,826	51,604	10,256	121,355	42,124	265,034
Increment Due to Project	0	0	1,685	0	216	534	106	1,255	434	4,230
1990										
Baseline Without Project	748	264	13,690	12,930	18,560	63,670	13,110	148,600	51,200	322,772
With the Project	748	264	13,709	12,930	18,806	63,761	13,129	148,813	51,273	323,427
Increment Due to Project	0	0	19	0	246	91	19	213	73	655
1995										
Baseline Without Project	777	296	16,019	15,607	21,777	76,163	15,824	176,340	59,530	382,333
With the Project	777	296	16,040	15,607	22,034	76,260	15,844	176,565	59,606	383,020
Increment Due to Project	0	0	21	0	257	97	20	225	76	687
2000										
Baseline Without Project	804	328	18,376	18,279	25,002	88,683	18,600	204,270	68,155	442,497
With the Project	804	328	18,398	18,279	25,250	88,785	18,622	204,506	68,234	443,184
Increment Due to Project	0	0	22	0	248	102	22	236	79	687

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^a May not add due to round-off.

NOTE: Figures represent number of jobs.

TCU = transportation, communication, and utilities

FIRE = finance, insurance, and real estate

TABLE 2-3

Impacts to Incomes

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
KANE COUNTY										
1980										
Baseline Without Project	1.07	0	1.71	0.53	0.53	1.89	0.25	2.77	2.01	10.74
1985										
Baseline Without Project	1.34	0.0	2.43	0.85	0.69	2.73	0.43	4.27	3.04	15.81
With the Project	1.34	12.50	6.38	0.85	1.52	3.47	0.54	5.53	3.86	36.04
Increment Due to Project	0	12.50	3.95	0	0.83	0.74	0.09	1.26	0.82	20.23
1990										
Baseline Without Project	1.53	0	3.11	1.24	0.95	3.63	0.50	5.60	4.17	20.73
With the Project	1.53	22.73	3.99	1.24	1.94	4.66	0.63	7.19	5.35	49.25
Increment Due to Project	0	22.73	0.88	0	0.99	1.03	0.13	1.59	1.18	28.52
1995										
Baseline Without Project	1.67	0	3.91	1.64	1.15	4.54	0.65	7.17	5.35	26.08
With the Project	1.67	29.73	5.09	1.64	2.29	5.92	0.86	9.39	6.97	63.56
Increment Due to Project	0	29.73	1.18	0	1.14	1.38	0.21	2.22	1.62	37.48
2000										
Baseline Without Project	1.93	0	5.00	2.23	1.45	5.84	0.84	9.39	7.06	33.77
With the Project	1.93	34.93	6.34	2.23	2.73	7.39	1.07	10.97	8.92	76.54
Increment Due to Project	0	34.93	1.34	0	1.28	1.55	0.23	1.58	1.86	42.77
CLARK COUNTY										
1980										
Baseline Without Project	16.37	3.22	182.13	125.43	234.22	412.88	107.31	1,246.70	411.44	2,739.31
1985										
Baseline Without Project	18.96	4.16	252.03	187.51	326.93	602.63	159.09	1,782.52	557.81	3,891.64
With the Project	18.96	4.16	289.74	187.51	331.56	608.94	160.77	1,801.15	563.65	3,966.43
Increment Due to Project	0	0	37.71	0	4.63	6.31	1.68	18.63	5.84	74.79
1990										
Baseline Without Project	21.48	5.16	338.62	260.64	441.26	829.49	226.84	2,435.11	756.38	5,314.99
With the Project	21.48	5.16	339.09	260.64	447.06	830.68	227.17	2,438.60	757.46	5,327.34
Increment Due to Project	0	0	0.47	0	5.80	1.19	0.33	3.49	0.08	12.35
1995										
Baseline Without Project	24.15	6.38	437.46	347.35	571.65	1,095.53	302.35	3,190.34	970.99	6,946.20
With the Project	24.15	6.38	438.04	347.35	578.10	1,096.95	302.75	3,194.50	972.27	6,960.49
Increment Due to Project	0	0	0.58	0	6.45	1.42	0.40	4.16	1.28	14.29
2000										
Baseline Without Project	28.14	7.81	554.61	449.17	724.61	1,408.37	392.37	4,080.29	1,227.34	8,872.71
With the Project	28.14	7.81	555.27	449.17	731.80	1,409.99	392.83	4,085.03	1,228.76	8,888.80
Increment Due to Project	0	0	0.66	0	7.19	1.62	0.46	4.74	1.42	16.09

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980.

May not add due to round-off.

NOTE: Figures represent millions of 1977 dollars.

TCU = transportation, communication, and utilities

FIRE = finance, insurance, and real estate

TABLE 2-4
Impacts to Law Enforcement Needs

[illegible]

Source: BLM, Calculated from Centaur Associates, Inc., *Socioeconomics*, 1980.
 a. One officer half time or less.
 b. One officer more than half time.
 NOTE: Figures represent number of police officers.

TABLE 2-5

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980.
NOTE: Figures represent pumping capacity in gallons pumped per minute.

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980.
NOTE: Figures represent pumping capacity in gallons pumped per minute.

TABLE 2-6

Impacts to Water Supply Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County												
Alton	.034	.023	.093	.093	.027	.070	.115	.030	.088	.132	.030	.102
Glendale	.106	.140	.365	.365	.147	.225	.470	.144	.323	.470	.144	.326
Kanab	.943	1.309	1.935	1.935	1.542	.626	2.330	1.730	.788	2.639	1.730	.909
Orderville	.193	.230	.510	.510	.271	.280	.624	.271	.353	.678	.271	.407
Clark County												
Las Vegas												
Valley	213.518	260.376	264.326	264.326	307.234	3.949	307.930	354.092	.696	354.815	354.092	.722
				2000								
Kane County												
Alton		.035	.141	.141		.106						
Glendale		.142	.484	.484		.342						
Kanab		1.996	2.951	2.951		.955						
Orderville		.275	.701	.701		.426						
Clark County												
Las Vegas		400.950	401.686	401.686		.736						
Valley												

Source: BLW, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: All figures represent million gallons per day peak demand and are based upon a standard of 450 gallons per person per day (roughly equivalent to 1,600 gallons per day per hook-up with 3.5-4.0 persons per hook-up).

TABLE 2-7

Impacts to Sewage Treatment Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County												
Alton	.013	.008	.035			.027	.010	.043	.033	.011	.049	.038
Glendale and Orderville	.111	.138	.326			.188	.156	.393	.237	.155	.428	.273
Kanab	.352	.489	.722			.233	.576	.870	.294	.616	.985	.369
Clark County												
Las Vegas Valley	79.713	97.207	98.682	1.474	114.701	114.961			.260	132.194	132.464	.270
			2000									
Kane County												
Alton		.013	.053			.040						
Glendale and Orderville		.156	.442			.286						
Kanab		.715	1.102			.387						
Clark County												
Las Vegas Valley		149.688	149.963	.275								

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: All figures represent million gallons per day effluent and are based upon a standard of 168 gallons effluent per day per person.

TABLE 2-8
Impacts to School Enrollments and Staffing Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection
Kane County Enrollments Staffing ^a	933 40 b(54)	1,260 50	1,927 84	667 34	1,485 59	2,325 102	840 43	1,666 67	2,634 116	968 49		
Clark County Enrollment Staffing ^a	94,495 4,534	115,232 5,524	117,049 5,611	1,817 87	135,970 6,524	136,290 6,539	320 15	156,708 7,520	157,040 7,536	332 16		
			2000									
Kane County Enrollment Staffing ^a		1,922 77	2,938 129	1,016 52								
Clark County Enrollment Staffing ^a		177,445 8,515	177,783 8,531	338 16								

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
^a Staffing requirements based upon a maximum student/teacher ratio of 25:1.
^b Figures in parentheses represent existing (1980) staffing levels.

TABLE 2-9
Impacts to Health Care Facility Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Increment Due to Project
Kane County Hospital Nursing Home	6 23	7 26		11 35	4 9		9 29	14 40	5 11	10 32	15 44	5 8
Clark County Hospital Nursing Home	1,252 978	1,528 1,190		1,552 1,209	24 19		1,803 1,403	1,807 1,406	4 3	2,087 1,615	2,092 1,618	5 3
				2000								
Kane County Hospital Nursing Home		11 35		17 48	6 13							
Clark County Hospital Nursing Home		2,352 1,827		2,357 1,831	5 4							

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Figures represent number of bed spaces.

TABLE 3-1
Impacts to Population

	1980			1985			1990			1995		
	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection
Kane County	3,929	5,040	5,823	783	5,938	6,960	1,022	6,662	7,687	1,025		
Alton	75	50	96	46	59	119	60	67	127	60		
Glendale	235	312	458	146	327	518	191	320	511	191		
Kanab	2,095	2,908	3,317	409	3,426	3,959	533	3,844	4,379	535		
Orderville	428	512	694	182	603	841	238	603	842	239		
Washington County	24,901	30,578	38,681	8,103	35,012	37,081	2,069	38,794	41,042	2,248		
Hurricane	2,379	2,565	3,198	633	2,668	2,830	162	2,657	2,833	176		
Ivins	594	599	774	175	739	784	45	892	940	48		
LaVerkin	1,167	1,272	1,571	299	1,485	1,561	76	1,676	1,759	83		
Leeds	217	269	332	63	308	324	16	341	359	18		
St. George	11,111	15,167	20,632	5,465	17,646	19,041	1,395	19,859	20,374	1,515		
Santa Clara	1,063	1,040	1,393	353	1,218	1,308	90	1,377	2,475	98		
Toquerville	282	266	337	71	305	323	18	388	408	20		
Washington	2,218	2,413	3,461	1,048	2,612	2,880	268	3,061	3,351	290		
Clark County												
Las Vegas Valley	474,485	578,614	587,390	8,776	682,743	684,289	1,546	786,872	788,477	1,605		
2000												
Kane County												
Alton		7,688	8,651	1,063								
Glendale		77	139	62								
Kanab		316	515	199								
Orderville		4,436	4,991	555								
		611	859	248								
Washington County												
Hurricane		43,177	45,517	2,340								
Ivins		2,625	2,808	183								
LaVerkin		1,071	1,122	51								
Leeds		1,900	1,986	86								
St. George		380	398	18								
Santa Clara		22,443	24,021	1,578								
Toquerville		1,563	1,665	102								
Washington		376	397	21								
		3,584	3,887	303								
Clark County												
Las Vegas Valley		891,000	892,635	1,635								

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
Figures will not sum to county totals because of outlying populations.

TABLE 3-2

Impacts to Employment

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
KANE COUNTY										
1980										
Baseline Without Project	168	0	75	84	46	281	28	281	253	1,216
1985										
Baseline Without Project	190	0	101	123	55	370	45	391	348	1,623
With the Project	190	210	165	123	155	420	51	449	395	2,158
Increment Due to Project	0	210	64	0	100	50	6	58	47	535
1990										
Baseline Without Project	197	0	116	162	70	442	46	466	431	1,930
With the Project	197	210	126	162	175	505	53	532	492	2,452
Increment Due to Project	0	210	10	0	105	63	7	66	61	522
1995										
Baseline Without Project	196	0	132	196	75	501	57	540	501	2,198
With the Project	196	210	132	196	179	578	66	624	578	2,759
Increment Due to Project	0	210	0	0	104	77	9	84	77	561
2000										
Baseline Without Project	203	0	155	242	88	586	67	641	598	2,580
With the Project	203	210	155	242	191	666	77	728	678	3,150
Increment Due to Project	0	210	0	0	103	80	10	7	80	570
WASHINGTON COUNTY										
1980										
Baseline Without Project	568	17	551	729	314	2,680	390	1,371	1,866	8,482
1985										
Baseline Without Project	582	20	642	973	361	3,089	481	1,695	2,176	10,019
With the Project	582	20	1,656	973	623	3,532	550	1,939	2,488	12,363
Increment Due to Project	0	0	1,014	0	262	443	69	244	312	2,344
1990										
Baseline Without Project	579	11	715	1,158	409	3,406	556	1,987	2,520	11,341
With the Project	579	11	749	1,158	543	3,564	582	2,081	2,650	11,917
Increment Due to Project	0	0	34	0	134	158	26	94	130	576
1995										
Baseline Without Project	560	12	772	1,358	436	3,662	635	2,242	2,765	12,442
With the Project	560	12	811	1,358	571	3,846	667	2,355	2,904	13,084
Increment Due to Project	0	0	39	0	135	184	32	113	139	642
2000										
Baseline Without Project	561	14	835	1,560	479	3,968	712	2,531	3,038	13,698
With the Project	561	14	876	1,560	616	4,158	747	2,649	3,180	14,361
Increment Due to Project	0	0	41	0	137	190	35	118	142	663

(continued)

TABLE 3-2 (concluded)

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
CLARK COUNTY										
1980										
Baseline Without Project	695	201	8,976	7,585	12,110	38,630	7,559	92,740	33,950	202,446
1985										
Baseline Without Project	729	235	11,250	10,270	15,310	51,070	10,150	120,100	41,690	260,804
With the Project	729	235	12,935	10,270	15,526	51,604	10,256	121,355	42,124	265,034
Increment Due to Project	0	0	1,685	0	216	534	106	1,255	434	4,230
1990										
Baseline Without Project	748	264	13,690	12,930	18,560	63,670	13,110	148,600	51,200	322,772
With the Project	748	264	13,709	12,930	18,806	63,761	13,129	148,813	51,273	323,427
Increment Due to Project	0	0	19	0	246	91	19	213	73	655
1995										
Baseline Without Project	777	296	16,019	15,607	21,777	76,163	15,824	176,340	59,530	382,333
With the Project	777	296	16,040	15,607	22,034	76,260	15,844	176,565	59,606	383,020
Increment Due to Project	0	0	21	0	257	97	20	225	76	687
2000										
Baseline Without Project	804	328	18,376	18,279	25,002	88,683	18,600	204,270	68,155	442,497
With the Project	804	328	18,398	18,279	25,250	88,785	18,622	204,506	68,234	443,184
Increment Due to Project	0	0	22	0	248	102	22	236	79	687

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980.
May not add due to round-off.

NOTE: Figures represent number of jobs.

TCU = transportation, communication, and utilities
FIRE = finance, insurance, and real estate

TABLE 3-3

Impacts to Incomes

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
KANE COUNTY										
1980 Baseline Without Project	1.07	0.0	1.71	0.53	0.53	1.89	0.25	2.77	2.01	10.74
1985 Baseline Without Project	1.34	0.0	2.43	0.85	0.69	2.73	0.43	4.27	3.04	15.81
With the Project	1.34	5.15	3.97	0.85	1.94	3.10	0.49	4.90	3.45	25.19
Increment Due to Project	0	5.15	1.54	0	1.25	0.37	0.06	0.63	0.41	9.41
1990 Baseline Without Project	1.53	0	3.11	1.24	0.95	3.63	0.50	5.60	4.17	20.73
With the Project	1.53	5.68	3.38	1.24	2.38	4.15	0.58	6.39	4.76	30.09
Increment Due to Project	0	5.68	0.27	0	1.43	0.52	0.08	0.79	0.59	9.36
1995 Baseline Without Project	1.67	0	3.91	1.64	1.15	4.54	0.65	7.17	5.35	26.08
With the Project	1.67	6.15	3.91	1.64	2.74	5.24	0.75	8.29	6.17	36.56
Increment Due to Project	0	6.15	0	0	1.59	0.70	0.10	1.12	0.82	10.48
2000 Baseline Without Project	1.93	0	5.00	2.23	1.45	5.84	0.84	9.39	7.06	33.77
With the Project	1.93	6.79	5.00	2.23	3.15	6.64	0.97	10.66	8.00	45.37
Increment Due to Project	0	6.79	0	0	1.70	0.80	0.13	1.27	0.94	11.63
WASHINGTON COUNTY										
1980 Baseline Without Project	13.94	0.28	7.61	8.25	5.96	21.10	4.04	13.94	16.51	91.72
1985 Baseline Without Project	15.88	0.24	9.72	12.21	7.71	26.91	5.45	18.97	21.34	118.54
With the Project	15.88	0.24	25.07	12.21	13.31	30.77	6.23	21.70	24.40	149.81
Increment Due to Project	0	0	15.35	0	5.60	3.86	0.78	2.73	3.06	31.38
1990 Baseline Without Project	17.49	0.29	11.90	16.02	9.41	32.77	7.05	24.54	27.19	146.97
With the Project	17.49	0.29	12.47	16.02	12.49	34.29	7.38	25.70	28.59	154.72
Increment Due to Project	0	0	0.57	0	3.08	1.52	0.33	1.16	1.40	8.06
1995 Baseline Without Project	18.25	0.35	14.33	20.69	11.32	38.91	8.84	30.60	32.90	176.88
With the Project	18.25	0.35	15.05	20.69	14.83	40.87	9.29	32.14	34.55	186.02
Increment Due to Project	0	0	0.72	0	3.51	1.96	0.45	1.54	1.65	9.83
2000 Baseline Without Project	20.48	0.43	17.07	26.24	13.65	46.30	10.88	37.98	40.11	231.35
With the Project	20.48	0.43	17.91	26.24	17.55	48.52	11.41	39.75	41.98	224.27
Increment Due to Project	0	0	0.84	0	3.90	2.22	0.53	1.77	1.87	11.13

(continued)

TABLE 3-3 (concluded)

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
CLARK COUNTY										
1980										
Baseline Without Project	16.37	3.22	182.13	125.43	234.22	412.88	107.31	1246.70	411.44	2,739.31
1985										
Baseline Without Project	18.96	4.16	252.03	187.51	326.93	602.63	159.09	1,782.52	557.81	3,891.64
With the Project	18.96	4.16	289.74	187.51	331.56	608.94	160.77	1,801.15	563.65	3,966.43
Increment Due to Project	0	0	37.71	0	4.63	6.31	1.68	18.63	5.84	74.79
1990										
Baseline Without Project	21.48	5.16	338.62	260.64	441.26	829.49	226.84	2,435.11	756.38	5,314.99
With the Project	21.48	5.16	339.09	260.64	447.06	830.68	227.17	2,438.60	757.46	5,327.34
Increment Due to Project	0	0	.47	0	5.80	1.19	.33	3.49	.08	12.35
1995										
Baseline Without Project	24.15	6.38	437.46	347.35	571.65	1,095.53	302.35	3,190.34	970.99	6,946.20
With the Project	24.15	6.38	438.04	347.35	578.10	1,096.95	302.75	3,194.50	972.27	6,960.49
Increment Due to Project	0	0	.58	0	6.45	1.42	.40	4.16	1.28	14.29
2000										
Baseline Without Project	28.14	7.81	554.61	449.17	724.61	1,408.37	392.37	4,080.29	1,227.34	8,872.71
With the Project	28.14	7.81	555.27	449.17	731.80	1,409.99	392.83	4,085.03	1,228.76	8,888.80
Increment Due to Project	0	0	.66	0	7.19	1.62	.46	4.74	1.42	16.09

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^aMay not add due to round-off.

NOTE: Figures represent millions of 1977 dollars.

TCU = transportation, communications, and utilities

FIRE = finance, insurance, and real estate

TABLE 3-5

Impacts to Fire Protection Needs

	1980				1985				1990				1995			
	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project
Kane County																
Alton	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
Glendale	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
Kanab	1,500-1,750	1,500-1,750	2,000-2,250	250-750	1,500-1,750	2,000-2,250	2,000-2,250	0-500	1,750-2,000	1,750-2,000	2,000-2,250	0-500	1,750-2,000	2,250-2,500	2,250-2,500	250-750
Orderville	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	1,000-1,250	0-750	500-1,000	1,000-1,250	1,000-1,250	0-750
Washington County																
Hurricane	1,500-1,750	1,500-1,750	1,750-2,000	0-500	1,500-1,750	1,750-2,000	1,750-2,000	0-500	1,500-1,750	1,500-1,750	1,750-2,000	0-500	1,500-1,750	1,750-2,000	1,750-2,000	0-500
Ivins	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	750-1,000	0-500	500-1,000	1,000-1,250	1,000-1,250	0-750
LaVerkin	1,000-1,250	1,000-1,250	1,250-1,500	0-500	1,000-1,250	1,250-1,500	1,250-1,500	0-500	1,000-1,250	1,000-1,250	1,250-1,500	0-250	1,250-1,500	1,500-1,750	1,500-1,750	0-500
Leeds	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
St. George	3,000-3,500	3,500-4,000	4,500-4,750	500-1,250	3,500-4,000	4,500-4,750	4,500-4,750	0-500	4,000-4,500	4,000-4,500	4,250-4,500	0-500	4,000-4,500	4,500-4,750	4,500-4,750	0-750
Santa Clara	1,000-1,250	1,000-1,250	1,250-1,500	0-500	1,000-1,250	1,250-1,500	1,250-1,500	0-500	1,000-1,250	1,000-1,250	1,250-1,500	0-500	1,000-1,250	1,250-1,500	1,250-1,500	0-500
Toquerville	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
Washington	1,500-1,750	1,500-1,750	2,000-2,250	250-750	1,500-1,750	2,000-2,250	2,000-2,250	250-750	1,500-1,750	1,500-1,750	1,750-2,000	0-500	1,750-2,000	2,000-2,250	2,000-2,250	0-500
Clark County																
Las Vegas																
Valley	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000
2000																
Kane County																
Alton	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
Glendale	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
Kanab	2,000-2,250	2,000-2,250	2,250-2,500	0-500	2,000-2,250	2,250-2,500	2,250-2,500	0-500	2,000-2,250	2,000-2,250	2,250-2,500	0-500	2,000-2,250	2,250-2,500	2,250-2,500	0-500
Orderville	500-1,000	500-1,000	1,000-1,250	0-750	500-1,000	1,000-1,250	1,000-1,250	0-750	500-1,000	500-1,000	1,000-1,250	0-750	500-1,000	1,000-1,250	1,000-1,250	0-750
Washington County																
Hurricane	1,500-1,750	1,500-1,750	1,750-2,000	0-500	1,500-1,750	1,750-2,000	1,750-2,000	0-500	1,500-1,750	1,500-1,750	1,750-2,000	0-500	1,500-1,750	1,750-2,000	1,750-2,000	0-500
Ivins	1,000-1,250	1,000-1,250	1,250-1,500	0-500	1,000-1,250	1,250-1,500	1,250-1,500	0-500	1,000-1,250	1,000-1,250	1,250-1,500	0-500	1,000-1,250	1,250-1,500	1,250-1,500	0-500
LaVerkin	1,250-1,500	1,250-1,500	1,500-1,750	0-500	1,250-1,500	1,500-1,750	1,500-1,750	0-500	1,250-1,500	1,250-1,500	1,500-1,750	0-500	1,250-1,500	1,500-1,750	1,500-1,750	0-500
Leeds	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
St. George	4,500-5,000	4,500-5,000	4,750-5,000	0-500	4,500-5,000	4,750-5,000	4,750-5,000	0-500	4,500-5,000	4,500-5,000	4,750-5,000	0-500	4,500-5,000	4,750-5,000	4,750-5,000	0-500
Santa Clara	1,250-1,500	1,250-1,500	1,500-1,750	0-500	1,250-1,500	1,500-1,750	1,500-1,750	0-500	1,250-1,500	1,250-1,500	1,500-1,750	0-500	1,250-1,500	1,500-1,750	1,500-1,750	0-500
Toquerville	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500	500-1,000	500-1,000	500-1,000	0-500
Washington	1,750-2,000	1,750-2,000	2,000-2,250	0-500	1,750-2,000	2,000-2,250	2,000-2,250	0-500	1,750-2,000	1,750-2,000	2,000-2,250	0-500	1,750-2,000	2,000-2,250	2,000-2,250	0-500
Clark County																
Las Vegas																
Valley	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Figures represent pumping capacity in gallons pumped per minute.

TABLE 3-6
Impacts to Water Supply Needs

	1980			1985			1990			1995		
	Baseline Projection	Baseline Needs	With the Project	Baseline Projection	Baseline Needs	With the Project	Baseline Projection	Baseline Needs	With the Project	Baseline Projection	Baseline Needs	With the Project
Kane County												
Alton	.034	.023	.043				.027	.054	.027	.027	.054	.027
Glendale	.106	.140	.206				.147	.233	.086	.147	.230	.083
Kanab	.943	1.309	1.493				1.542	1.782	.240	1.542	1.971	.429
Orderville	.193	.230	.312				.271	.378	.107	.271		
Washington County												
Hurricane	1.071	1.154	1.439				1.201	1.274	.073	1.196	1.275	.079
Ivins	.267	.270	.348				.333	.353	.020	.401	.423	.022
LaVerkin	.525	.572	.707				.668	.702	.034	.754	.792	.038
Leeds	.098	.121	.149				.139	.146	.007	.153	.162	.009
St. George ^a	6.181	7.368	12.427				7.368	12.182	4.814	10.473	18.112	1.639
Santa Clara	.478	.468	.627				.468	.589	.121	.620	1.114	.494
Toquerville	.128	.120	.152				.120	.145	.025	.152	.184	.032
Washington	.990	1.086	1.557				1.086	1.296	.210	1.377	1.508	.131
Clark County												
Las Vegas Valley	213.518	260.376	264.326				307.234	307.930	.696	354.092	354.815	.722
			2000									
Kane County												
Alton		.035	.063						.028			
Glendale		.142	.232						.090			
Kanab		1.996	2.246						.250			
Orderville		.275	.537						.112			
Washington County												
Hurricane		1.181	1.264						.083			
Ivins		.482	.505						.023			
LaVerkin		.855	.894						.039			
Leeds		.171	.179						.008			
St. George ^a		12.485	14.964						2.479			
Santa Clara		.703	.749						.046			
Toquerville		.169	.179						.010			
Washington		1.613	1.749						.136			
Clark County												
Las Vegas Valley		400.950	401.686						.736			

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^a Totals for St. George include amounts for Bloomington with water supplied by St. George.

NOTE: All figures represent million gallons per day peak demand and are based upon a standard of 450 gallons per person per day (roughly equivalent to 1,600 gallons per day per hook-up with 3.5-4.0 persons per hook-up).

TABLE 3-7
Impacts to Sewage Treatment Needs

	1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County									
Alton	.013	.008	.006	.010	.020	.010	.011	.021	.010
Glendale and Orderville	.111	.138	.056	.156	.228	.072	.155	.227	.172
Kanab	.352	.489	.068	.576	.665	.089	.616	.736	.120
Washington County									
Hurricane, LaVerkin, and Toquerville	.643	.689	.169	.749	.792	.043	.792	.840	.046
Ivins	.100	.101	.029	.124	.132	.008	.132	.158	.026
Leeds	.036	.045	.011	.052	.054	.002	.054	.060	.006
St. George and Santa Clara	2.045	2.723	.977	3.169	3.419	.250	3.419	3.839	.420
Washington	.373	.405	.176	.439	.484	.045	.483	.563	.080
Clark County									
Las Vegas Valley	79.713	97.207	1.474	114.701	114.961	.260	132.194	132.464	.270
2000									
Kane County									
Alton	.013	.023	.010						
Glendale and Orderville	.156	.231	.075						
Kanab	.715	.838	.123						
Washington County									
Hurricane, LaVerkin, and Toquerville	.823	.872	.849						
Ivins	.180	.188	.008						
Leeds	.064	.067	.003						
St. George and Santa Clara	4.033	4.315	.051						
Washington	.602	.653							
Clark County									
Las Vegas Valley	149.688	149.963	.275						

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
NOTE: All figures represent million gallons per day effluent and are based upon a standard of 168 gallons effluent per day per person.

TABLE 3-8
Impacts to School Enrollments and Staffing Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County Enrollments Staffing	933 40 b (54)	1,260 50	1,456 58	1,485 59	1,740 70	255 11	1,666 67	1,922 77	256 10			
Washington County Enrollments Staffing	6,300 252 b (260)	7,981 319	10,996 404	9,138 366	9,678 387	540 21	10,125 405	10,712 428	587 23			
Clark County Enrollment Staffing	94,495 4,534	115,232 5,524	117,049 5,611	135,970 6,524	136,290 6,539	320 15	156,708 7,520	157,040 7,536	332 16			
2000												
Kane County Enrollment Staffing		1,922 77	2,163 87			241 10						
Washington County Enrollment Staffing		11,269 451	11,880 475			611 24						
Clark County Enrollment Staffing		177,445	177,783			338						
	8,515	8,531	16									

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

a Staffing requirements based upon a maximum student/teacher ratio of 25:1.

b Figures in parentheses represent existing (1980) staffing levels.

TABLE 3-9
Impacts to Health Care Facility Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Kane County Hospital Nursing Home	6 23	7 26	1 3	8 29	8 29	1 3	9 29	9 29	1 4	10 32	10 32	1 3
Washington County Hospital Nursing Home	63 223	77 272	20 69	97 341	97 341	20 69	88 309	88 309	5 18	98 342	98 342	5 19
Clark County Hospital Nursing Home	1,252 978	1,528 1,190	24 19	1,552 1,209	1,552 1,209	24 19	1,803 1,403	1,803 1,403	4 3	2,087 1,615	2,087 1,615	5 3
					2000							
Kane County Hospital Nursing Home		11 35	2 3	13 38	13 38	2 3						
Washington County Hospital Nursing Home		109 379	5 20	114 399	114 399	5 20						
Clark County Hospital Nursing Home		2,352 1,827	5 4	2,357 1,831	2,357 1,831	5 4						

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Figures represent number of bed spaces.

TABLE 4-1
Impacts to Population

	1980			1985			1990			1995		
	Baseline Population Projection	Baseline Population Projection	Baseline Population Projection	Population With the Project	Increment Due to Project	Increment Due to Project	Baseline Population Projection	Population With the Project	Increment Due to Project	Baseline Population Projection	Population With the Project	Increment Due to Project
Clark County Las Vegas Valley	474,485	578,614	587,390		8,776		682,743	684,289	1,546	786,872	788,477	1,605
			2000									
Clark County Las Vegas Valley		891,000	892,635		1,635							

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980
 a Figures will not sum to county totals because of outlying populations.

TABLE 4-2
Impacts to Employment

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
CLARK COUNTY										
1980										
Baseline Without Project	695	201	8,976	7,585	12,110	38,630	7,559	92,740	33,950	202,446
1985										
Baseline Without Project	729	235	11,250	10,270	15,310	51,070	10,150	120,100	41,690	260,804
With the Project	729	235	12,935	10,270	15,526	51,604	10,256	121,355	42,124	265,034
Increment Due to Project	0	0	1,685	0	216	534	106	1,255	434	4,230
1990										
Baseline Without Project	748	264	13,690	12,930	18,560	63,670	13,110	148,600	51,200	322,772
With the Project	748	264	13,709	12,930	18,806	63,761	13,129	148,813	51,273	323,427
Increment Due to Project	0	0	19	0	246	91	19	213	73	655
1995										
Baseline Without Project	777	296	16,019	15,607	21,777	76,163	15,824	176,340	59,530	382,333
With the Project	777	296	16,040	15,607	22,034	76,260	15,844	176,565	59,606	383,020
Increment Due to Project	0	0	21	0	257	97	20	225	76	687
2000										
Baseline Without Project	804	328	18,376	18,279	25,002	88,683	18,600	204,270	68,155	442,497
With the Project	804	328	18,398	18,279	25,250	88,785	18,622	204,506	68,234	443,184
Increment Due to Project	0	0	22	0	248	102	22	236	79	687

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^a May not add due to round-off.

NOTE: Figures represent number of jobs.

TCU = transportation, communication, and utilities

FIRE = finance, insurance, and real estate

TABLE 4-3

Impacts to Incomes

	Agri- culture	Mining	Con- struction	Manufac- turing	TCU	Trade	FIRE	Services	Govern- ment	Total ^a
CLARK COUNTY										
1980										
Baseline Without Project	16.37	3.22	182.13	125.43	234.22	412.88	107.31	1,246.70	411.44	2,739.31
1985										
Baseline Without Project	18.96	4.16	252.03	187.51	326.93	602.63	159.09	1,782.52	557.81	3,891.64
With the Project	18.96	4.16	289.74	187.51	331.56	608.94	160.77	1,801.15	563.65	3,966.43
Increment Due to Project	0	0	37.71	0	4.63	6.31	1.68	18.63	5.84	74.79
1990										
Baseline Without Project	21.48	5.16	338.62	260.64	441.26	829.49	226.84	2,435.11	756.38	5,314.99
With the Project	21.48	5.16	339.09	260.64	447.06	830.68	227.17	2,438.60	757.46	5,327.34
Increment Due to Project	0	0	0.47	0	5.80	1.19	0.33	3.49	0.08	12.35
1995										
Baseline Without Project	24.15	6.38	437.46	347.35	571.65	1,095.53	302.35	3,190.34	970.99	6,946.20
With the Project	24.15	6.38	438.04	347.35	578.10	1,096.95	302.75	3,194.50	972.27	6,960.49
Increment Due to Project	0	0	0.58	0	6.45	1.42	0.40	4.16	1.28	14.29
2000										
Baseline Without Project	28.14	7.81	554.61	449.17	724.61	1,408.37	392.37	4,080.29	1,227.34	8,872.71
With the Project	28.14	7.81	555.27	449.17	731.80	1,409.99	392.83	4,085.03	1,228.76	8,888.80
Increment Due to Project	0	0	0.66	0	7.19	1.62	0.46	4.74	1.42	16.09

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

^a May not add due to round-off.

NOTE: Figures represent millions of 1977 dollars.

TCU = transportation, communication, and utilities

FIRE = finance, insurance, and real estate

TABLE 4-4

Impacts to Law Enforcement Needs

	1980		1985		1990		1995	
	Baseline Needs Projection	720	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Increment Due to Project
Clark County Las Vegas Valley			895			1,070		1,245
				2000				
Clark County Las Vegas Valley			1,420					

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Figures represent number of police officers.

TABLE 4-5

Impacts to Fire Protection Needs

	1980			1985			1990			1995		
	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project	Baseline Needs Projection	Baseline Needs Projection	Increment Due to Project
Clark County Las Vegas Valley	11,000-12,000	11,000-12,000	11,000-12,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	0-1,000	11,000-12,000	11,000-12,000	0-1,000
Clark County Las Vegas Valley												

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Figures represent pumping capacity in gallons pumped per minute.

TABLE 4-6

Impacts to Water Supply Needs

	1980		1985		1990		1995	
	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Increment Due to Project
Clark County Las Vegas Valley	213.518	260.376	264.326		3.949	307.234	354.092	.696
			2000					
Clark County Las Vegas Valley		400.950	401.686		.736			

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

Totals for St. George include amounts for Bloomington with water supplied by St. George.

NOTE: All figures represent million gallons per day peak demand and are based upon a standard of 450 gallons per person per day (roughly equivalent to 1,600 gallons per day per hook-up with 3.5-4.0 persons per hook-up).

TABLE 4-7
Impacts to Sewage Treatment Needs

	1980		1985		1990		1995	
	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Baseline Needs Projection	Needs With the Project
Clark County Las Vegas Valley	79.713	97.207	98.682	1.474	114.701	114.961	132.194	132.464
			2000					
Clark County Las Vegas Valley		149.688	149.963	.275				

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: All figures represent million gallons per day effluent and are based upon a standard of 168 gallons effluent per day per person.

TABLE 4-9
Impacts to Health Care Facility Needs

	1980		1985		1990		1995	
	Baseline Needs Projection	Baseline Needs Projection	Baseline Needs Projection	Needs With the Project	Increment Due to Project	Baseline Needs Projection	Needs With the Project	Increment Due to Project
Clark County Hospital Nursing Home	1,252 978	1,528 1,190	1,552 1,209	1,552 1,209	24 19	1,803 1,403	1,807 1,406	4 3
				2000				
Clark County Hospital Nursing Home		2,352 1,827	2,357 1,831	5 4			2,087 1,615	2,092 1,618
								5 3

Source: BLM, Calculated from Centaur Associates, Inc., Socioeconomics, 1980

NOTE: Figures represent number of bed spaces.

APPENDIX 18

State of Utah, Community Development Division -
Mitigation of Impacts in Kane and Washington
Counties



SCOTT M. MATHESON
GOVERNOR



STATE OF UTAH
DEPARTMENT OF COMMUNITY AND
ECONOMIC DEVELOPMENT

COMMUNITY DEVELOPMENT DIVISION

231 EAST 400 SOUTH, SUITE 100
SALT LAKE CITY, UTAH 84111
(801) 533-5396

MEMORANDUM

TO: Bureau of Land Management
U.S. Department of the Interior

FROM: Community Development Division 
Department of Community and Economic Development
State of Utah

SUBJECT: Mitigation of Impacts Due to the Development of the Alton Coal
Field and the Warner Valley Project in Kane and Washington Counties

DATE: April 14, 1980

The primary potential impacts and problems from subject developments will be social, cultural, and environmental. The positive effects will include added employment opportunities, public revenues, and personal income benefits related to the general stimulus of the local economies. Anticipated negative impacts will include urban sprawl, septic tank contamination, and inadequate water supplies to serve the population. The state has some capacity to address the following: (1) financing through prepayment of sales taxes to supply certain services due to impacts; (2) social and health services; and (3) capital facilities financing.

Prefinancing of Public Services

As soon as the Warner Valley Project and the Alton Coal Field have received necessary approvals, the financing of front-end public facilities will be the major problem faced by local governments in the area. To mitigate front-end financial problems associated with growth, federal and state assistance should address the primary problem of the affected local governments' ability to secure adequate facilities during the development period. The following are suggested solutions to community development front-end financial problems:

(1) Creation of a Federal/State/Local Revolving Loan Fund. This would provide capital for the planning and construction of major local government facilities and services, i.e., water, sewer, solid waste collection and disposal, roads, classrooms, and health facilities. The fund would be replenished with revenues derived from user fees.

(2) Rectifying Local Tax Imbalances. Several options are available whereby Washington and Kane Counties could transfer portions of their county tax bases from the projects to the cities:

- a. Special Services District Act. This Act allows two jurisdictions to join together as one governmental entity to pool their resources in providing public services and facilities. In addition, this Act provides exceptions to the debt limitations on municipal bonds for cities and counties. The debt limitation is set by the Act at 12 percent of the reasonable fair cash value, or 40 percent of the assessed value within the jurisdiction. This is higher than other existing statutory provisions which allow a debt limitation of 2 percent for counties and 4 percent for cities.
- b. Interlocal Cooperation Act. This Act, passed in 1965, enables counties and cities to associate in providing necessary public services. The Act permits use of a broader tax base for provision of services.
- c. Revenue Sharing. The Utah State Constitution should be amended to enable the State to share revenue with local governments and to allow counties to share revenues with municipalities.

(3) Prepayment of Sales and Use Taxes. State statute permits the prepayment of future sales and use taxes. A tax credit is given to the company at a time when the firm would normally pay the taxes. The revenues received from prepayment are earmarked for financing the construction of highways and schools within the impacted areas. This has a shortcoming, though, because revenues from this source will be collected by Kane and Washington Counties and will therefore not inure to the cities for municipal services.

(4) Other Sources of Capital for Public Improvements:

- a. Cities Water Loan Fund (Division of Water Resources).

Interest-free loans to incorporated municipalities, water improvement districts, and special service districts to help construct culinary water systems in areas of critical need throughout the state.
- b. Four Corners Regional Commission (Department of Community and Economic Development).

Supplemental and technical assistance (planning and study) grants to local governments in order to enhance the overall economy of the state and the Four Corners Region.
- c. Farmers Home Administration.

Financial assistance (grants and loans) for water and waste disposal facilities in communities with a population up to 10,000.
- d. Community Impact Account (Department of Community and Economic Development).

Assistance for communities impacted or potentially impacted by natural resource development where the need for public facilities and services is beyond the financial capability of local government.

Bureau of Land Management
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e. Environmental Protection Agency (Sewer Work Grants).

Funds to municipalities which have the most severe waste water disposal problems.

Note: Currently, one has to be mindful that the above programs will be affected by proposed federal budgetary cuts.

(5) Ability to Absorb Population Increases due to the Warner Valley Project.
Because of the proximity of Warner Valley to St. George, it can be anticipated that some in-migration due to its development can be absorbed in the St. George area. However, further planning should be engaged to determine exactly how much of that growth can be absorbed by St. George.

CPB/bob

APPENDIX 19

Energy Efficiency Summary of Alternatives 1, 2, 3, and 4

Component	Input of Resources (Btu per MW)			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Harry Allen Powerplant	9.35×10^{10}	1.17×10^{11}	9.35×10^{10}	1.17×10^{11}
Harry Allen Water Supply	1.23×10^8	1.54×10^8	1.23×10^8	1.54×10^8
Warner Valley Powerplant	2.32×10^{10}	N/A	2.32×10^{10}	N/A
Alton Coal Mine and Preparation Plant	1.49×10^{10}	1.50×10^{10}	2.65×10^9	N/A
Coal Slurry Pipeline	5.98×10^8	6.94×10^8	N/A	N/A
Transmission Lines	1.16×10^8	1.30×10^8	1.82×10^8	1.28×10^8
Line Loss	2.60×10^9	2.60×10^9	2.60×10^9	2.60×10^9
Warner Valley Water Project	8.57×10^7	N/A	1.71×10^8	N/A
Truck Transportation of Coal, Alton to Warner Valley	N/A	N/A	1.12×10^9	N/A
Central Utah Coal, Mining and Transportation	N/A	N/A	3.97×10^9	4.96×10^9
Southwestern Wyoming Coal, Mining and Transportation	N/A	N/A	4.67×10^9	5.83×10^9
Total Energy Input (Btu per MW)	1.35×10^{11}	1.35×10^{11}		
Using Central Utah Coal			1.28×10^{11}	1.25×10^{11}
Using Southwestern Wyoming Coal			1.28×10^{11}	1.26×10^{11}
Total ^a Electrical Energy Output (MW)	1,610	1,288	805	1,288
Energy Output (Btu per MW) ^b	2.98×10^{10}	2.98×10^{10}	2.99×10^{10}	2.98×10^{10}
Energy Efficiency (Percent Output of Input) ^c	22.1	22.1		
Using Central Utah Coal			23.4	24.0
Using Southwestern Wyoming Coal			23.3	23.8

Source: Bureau of Land Management, Utah State Office, Unpublished, 1980

^aOne MW = 2.99×10^{10} Btu

^bOutput of powerplants computed at substations; quantities reflect transmission line losses of 8 percent.

^cEnergy Efficiency = $\frac{\text{Output (Btu per MW)}}{\text{Input (Btu per MW)}}$

Example: Energy Efficiency of Alternative 1 = $\frac{2.98 \times 10^{10}}{1.35 \times 10^{11}} = 22.1$ percent

NOTE: Btu = British thermal unit
MW = megawatt
N/A - not applicable

GLOSSARY

Acre-foot. The volume of water (43,560 cubic feet) required to cover 1 acre to a depth of 1 foot.

Active Solar Space Heating Systems. Equipment designed to absorb the sun's energy and to use this energy to heat building space by use of mechanically-forced energy transfer such as fans or pumps.

Air Quality. The condition of the air usually expressed by the content of various chemicals and particles naturally or artificially occurring in the area.

Air Quality Classes. Classes established by the Environmental Protection Agency (EPA) that define the amount of air pollution considered significant within an area. Class I applies to areas where almost any change in air quality would be considered significant; Class II applies to areas where the deterioration normally accompanying moderate well-controlled growth would be considered insignificant; and Class III applies to areas where deterioration up to the national standards would be considered insignificant.

Air Quality Modeling. A quantitative technique of estimating the effects of emissions from a polluting source (e.g., a powerplant) on the existing local or regional air quality.

Alluvial Valleys. Unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities.

Alluvium. Clay, silt, sand, and gravel or other rock material transported by flowing water and deposited as sorted or semi-sorted sediments.

Alternative Energy Sources. Renewable and nonconventional sources used to produce electrical energy including: cogeneration; biomass; solar, wind, and geothermal technology; fuel cells; and hydroelectric technology.

Ambient Air. The air encompassing or surrounding a particular region.

Ambient Air Quality. Concentration levels in the ambient air for a specified pollutant within a specified averaging time period.

Ambient Pollutant Concentrations. Existing levels of contaminants in the local or regional air, usually pertaining to concentrations of particulate matter, sulfur dioxides, nitrogen oxides, ozone, and trace elements.

Annual Compound Growth Rate. The rate at which a community's population increases each year for a given number of years. The growth rate is expressed in percent and calculated from the equation $R = (1+i)^{1/n} - 1$ where:

R = annual compound growth rate

i = the total percent increase for the given number of years

n = the period of time or number of years under consideration

Apparent View Contrast. The contrast of a view as seen from an observer's position. Contrast is the relative difference between the luminance (brightness) of an object and the luminance of its background.

Appliance and Motor Efficiency. Improving the seasonal efficiency of the energy consuming equipment and distribution systems by modification, maintenance, or replacement.

Aquifer. A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian (confined) Aquifer. A water-yielding zone in which ground water is confined under pressure by impervious or semipervious strata.

Atmosphere Chemical Transformation. A phenomenon which occurs when certain chemical emissions from an industrial or powerplant source combine with other chemicals already existing in the air to form still another chemical or compound which may or may not be considered a pollutant.

Atmospheric Discoloration. A pollution-caused change in the color of the sky, distant mountains, clouds, or other objects (EPA, 1979). Atmospheric discoloration is often defined as a yellow or brown haze caused by absorption of blue light by nitrogen dioxide (NO_x).

Authorized Officer. A Federal regulatory agency employee(s) designated responsible for activities involving the use of public lands or delegated to exercise authority with respect to grants for use of these lands.

Base Flow. The flow of water entering stream channels from ground water sources.

Baseload. The minimum load of a utility over a given period of time.

Berm. An earthen terrace or low linear ridge which can be formed by natural processes or construction activities.

Best Available Control Technology (BACT). Various methods and equipment available within the current technology to best control air pollutants and dust generated during construction, mining, or industrial (including powerplant) activities.

Biomass Energy Technology. A process of generating energy utilizing biomass (solid waste, agriculture, and forest residues, etc.) as the fuel. The biomass can be burned to generate heat which warms a boiler and creates steam or it can be fermented and distilled to make clean-burning fuels such as methanol.

Borrow Material. Material (sand, gravel, etc.) excavated in order to provide fill elsewhere.

British Thermal Unit (Btu). The quantity of heat required to raise the temperature of 1 pound of water 1°F at or near 39.2°F .

Building Controls. Equipment designed to provide a constant surveillance of the building and to make the most effective use of physical plant systems and personnel.

Building Efficiency Codes. Mandatory measures adopted by local governments for energy conservation and maximum building efficiency.

Building Envelope. The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior.

Cambrian. The first period of the Paleozoic era, thought to have included the span of time from 570 million years ago to 500 million years ago.

Capacity. Maximum power output, expressed in kilowatts or megawatts. Equivalent terms: peak capability, peak generation, firm peakload, and carrying capability. In transmission, the maximum load a transmission line is capable of carrying.

Capacity Factor. The ratio of the average power load of an electrical powerplant to its rated capacity.

Caulking. Pliable materials used to reduce the passage of air and moisture by filling small gaps: (1) at fixed joints on a building, (2) underneath baseboards inside a building, (3) in exterior walls at electrical outlets, and (4) around pipes and wires entering a building.

Clean Air Act (42 USC 1857 et. seq.). An act for air pollution prevention and control: (1) to protect and enhance public health and welfare and the productive capacity of its population, (2) to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution, (3) to provide technical and financial assistance to State and local governments in connection with the development and execution of their air pollution prevention and control programs, (4) to encourage and assist the development and operation of regional air pollution control programs.

Clock Thermostat. A device which is designed to reduce energy consumption by regulating the demand on the heating or cooling system in which it is installed, by using: (1) a temperature control device for interior spaces incorporating more than one temperature control level, and (2) a clock or other automatic mechanism for switching from one control level to another.

Closed Basin. The depressed topographic feature in which water can run by means of surface drainage, but from which there is no surface outlet.

Coal Processing Facility. A facility used to clean, sort, and pulverize coal for purposes of mixing it with water to form a coal slurry.

Coal Slurry. A mixture consisting of approximately 50-percent water and 50 percent pulverized coal.

Cogeneration. The capture and utilization of waste heat or steam from industrial and manufacturing processes in order to produce electricity.

Conditioned Space. The portion of interior space which is contained within exterior walls and which is conditioned directly or indirectly by an energy-using system.

Cone of Depression. A depression in the water table (roughly conical) caused by pumping.

Conservation. Improving the efficiency of energy use; using less energy to produce the same product or results.

Continuous Miners. Machinery used to mine coal underground, employing a system of shovels mounted on a revolving wheel that scrape coal from the mine walls and deposit it on a conveyor for transport.

Cost-Effective. An economic criteria for comparing alternatives in terms of the net benefits they produce per dollar value.

Cultural Resources. Nonrenewable remains of human activities, occupations, and endeavors as reflected in sites, buildings, structures, or objects, including works of art, architecture, and engineering. Cultural resources are commonly discussed as prehistoric and historic values, but each period represents a part of the full continuum of cultural values from the earliest to the most recent.

Decommissioning. The act of taking a power generating or industrial facility out of service, sometimes referred to as mothballing.

Degree Day, Heating. A unit, based upon the temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F, there exists as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F.

Demographics. Characteristics of human populations such as size, growth, density, distribution, and vital statistics.

Depositional Valleys. Topographic valleys formed or being formed by deposition of sediments.

Direct Heat Gain. The south-facing panels of insulated glass, or similar transparent substances admitting the sun's rays into the building space where heat is stored in a thermal storage mass. Thus, the actual building space is directly heated by the sun.

Direct Load Management Systems. Customer-owned or leased devices that reduce the maximum kilowatt demand on an electric utility, and which are either:

- (1) Part of a radio, ripple, or other utility controlled-load switching system on the customer's premises.

- (2) Clock-controlled load-switching devices.
- (3) Interlocks and other load-actuated, load-limiting devices.
- (4) Energy storage devices with control systems.

Directional Drilling. A method of locating oil and gas reserves which do not lie directly under the drilling surface.

Dragline Mining. A method of surface mining incorporating the use of large "steamshovels" or draglines which remove overlying layers of earth until reaching the ore or coal-bearing formation. The ore or coal is then removed with front-loading equipment.

Duct Insulation. A material primarily designed to resist heat flow which is installed on a heating or cooling duct in an unconditioned area of a building.

Econometrics. The use of sophisticated mathematical, statistical, and other analytic methods to make quantitative economic analyses.

Economy of Scale. The reduction in unit costs as large quantities of a product are made.

Efficiency. The ratio of useful energy to the thermal energy input for a designated time period, expressed in percent.

Effluent. The mixture of substances, gases, liquids, and suspended matter discharged into the atmosphere (or ground, river, ocean) as the result of a given process.

Electrostatic Precipitator. A means of removing particulates from gases. Particles are given an electrical charge and attracted to a plate with an opposite charge.

Endangered Species. Any animal or plant species in danger of extinction throughout all or a significant portion of their range.

End-Use. An appliance or item of equipment which uses energy to perform a useful function in a house, business, or industry (e.g., a dishwasher).

Energy Conservation. Reducing the amount of energy which a building uses during a period of time.

Entry Heading. A main tunnel for initiating underground mining entries into a coal-bearing strata.

Ephemeral Surface Water. Surface water directly resulting from rainfall or snowmelt, with flows of limited duration.

Evaporative Cooling. The use of a device which utilizes the heat absorbed by the evaporation of water as the primary source of cooling.

Facade Lighting. The lighting of the exterior of a building for decorative purposes.

Fifty-Year (50-year) Storm. A storm intensity with a 2-percent probability of occurring within any given year based on past recorded storms or computed drainage flows.

Flocculation. The aggregation of fine particles of a medium into a mass.

Floodlighting. A lighting system designed to light an area using projector-type luminaires usually capable of being pointed in any direction.

Floodplain. Lands that are periodically covered by flood waters.

Formation. A body of rock large enough to be shown on a geologic map as a practical unit for mapping and having easily recognizable upper and lower boundaries that can be traced in the field.

Fossil Fuels. Coal, oil, natural gas, and other fuels originating from fossilized geologic deposits and depending on oxidation for release of energy.

Fuel Cells. A technique of producing electricity from a chemical process utilizing hydrogen.

Fugitive Dust. The solid, airborne particulate matter emitted from any source other than through a stack.

Gaging Station. A particular site on a stream or reservoir where systematic observations of height, discharge, or water quality parameters are obtained, usually by an automatic device.

Gaussian Dispersion Model. A quantitative technique for predicting the behavior and effects of emissions in the atmosphere from an industrial or powerplant source.

Geothermal Systems. Equipment that uses the natural heat in the earth's crust in the form of steam or hot water to produce electricity.

Ground Water. That part of the subsurface water that is the zone of saturation, supplies water to wells, and provides water that sustains the low flow of perennial streams.

Ground Water Accretion. Water added to the subsurface water supply from recharge by overlaying streams, adjacent aquifers, injection wells etc.

Head. The difference in elevation between two points in a body or column of fluid. With respect to hydrology, the head is the height of the water level within a column that equals the pressure of a confined aquifer at the point where the column enters that aquifer.

Heat Pumps. A device which can provide heating and cooling to a building space. The four basic types of heat pumps are air-to-air, water-to-air, water-to-water, and earth-to-air.

Heat Reflecting and Heat Absorbing Window or Door Material. A window or door glazing material with exceptional heat-absorbing or heat-reflecting properties, or reflective or absorptive films and coatings applied to an existing window or door which results in exceptional heat-absorbing or heat-reflecting properties.

Highwall. The unexcavated face of exposed overburden and coal in a surface mine or the face or bank on the uphill side of a contour strip mine excavation.

HVAC System. A system that provides either collectively or individually the processes of comfort heating, ventilating, and/or air conditioning within or associated with a building.

Hydraulic Conductivity. The rate at which water will move through a cross section of unit area under a unit hydraulic gradient. The usual units in the United States are cubic feet per day per square foot under a hydraulic gradient of one foot per foot, abbreviated to feet per day. Also known as "permeability."

Hydroelectric Plant. An electric powerplant in which the turbine-generator units are driven by falling water.

A conventional hydroelectric plant is one in which all the power is produced from natural streamflow as regulated by available storage.

A pumped storage hydroelectric plant is one in which power is produced during peakload periods by using water previously pumped from a lower reservoir to an upper reservoir during offpeak periods.

Indirect Heat Gain. The use of panels of insulated glass or similar transparent material to direct the sun's rays onto specially-constructed thermal walls, ceilings, rock beds, or containers of water or other fluids where heat is stored and radiated.

Infiltration. Unwanted outside air coming into a building through inadvertent openings in the building envelope, open doors, etc.

Infrastructural Services. Basic services such as police protection, fire protection, sewage disposal, water supply, etc., provided by local governments.

Insulation. A material primarily designed to resist heat flow which is installed within or on the spaces between conditioned areas of a building and unconditioned areas of a building or on the outside (including floors, walls, ceiling, crawl spaces, and foundations).

Intermittent Stream. A stream or portion of a stream that flows only at certain times of the year, usually in response to direct precipitation or an elevated water table.

Kilovolt (kV). The electromotive unit of force equal to 1,000 volts.

Kilowatt (kW). One thousand watts.

Kilowatt-hour (kWh). A basic unit of electrical energy which equals 1 kilowatt of power applied for 1 hour.

Lithic Scatter. An archaeological site characterized by the presence of flaked tools, chips, cores, or flakes only.

Load. The amount of electrical power that is drawn from a power line, generator, or other power source.

Load Management. A technique used by utilities to reduce the disparity between low electricity demand (troughs) and high electricity demand (peaks) in a given period of time.

Load Shedding. A method to shut off selected equipment according to the measurement of peak load to maintain the load below a given level.

Longwall Mining. A method of underground mining in which large panels are first developed by mining openings around the periphery of the panel. The longwall equipment, consisting of hydraulic shields, a pan conveyor, and a shear or plow mechanism, is installed at one end of the panel and progressively mines out the entire panel. The roof caves immediately behind the hydraulic shields. Ventilation is maintained through the previously developed openings and across the mining face under hydraulic shields. The coal, as mined, falls from the longwall face onto the pan conveyors that then move it to a conveyor established on one side of the panel.

Macro-Econometrics. The study of an entire economic system using econometric techniques.

Megawatt (MW). One million watts or 1 thousand kilowatts.

Micro-Econometrics. The study of individual portions of an economic system using econometric techniques.

Microwave Station. A communications station incorporating microwaves as the mode of message transport.

Mine Drainage. Any water forming on or discharging from a mining operation.

Motor Retrofit Measures. The replacement of the existing motor with a smaller or more efficient motor.

National Ambient Air Quality Standards (NAAQS). The allowable concentrations of air pollutants in the ambient air specified by the Federal government and found in Title 40, Code of Federal Regulations, Part 50. The ambient air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety, the primary standards are requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety, the secondary standards are requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air).

National Environmental Policy Act (NEPA). An act to declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality (CEQ).

National Historic Preservation Act of 1966. An act that declares a national policy of historic preservation including the encouragement of preservation on the State and private levels.

National Register of Historic Places. A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior.

Nephelometer. A general name for instruments which measure, at more than one angle, the scattering function of particles suspended in a medium.

New Source Performance Standards. A set of standards which limit the quantities of pollutants released into the atmosphere from plant stacks.

Night-Time Temperature Setback (residential). Manually or automatically lowering the thermostat control setting for the furnace during the heating season to a maximum of 55°F during sleeping hours.

Nitrogen Oxides (NO_x). Compounds produced by combustion, particularly when there is an excess of air or when combustion temperatures are very high. Nitrogen oxides are primary air pollutants.

Nonattainment Area. An area already characterized by significant levels of air pollution. Such areas are restrictive of any significant increases in certain pollutants caused by new sources (industrial or powerplant).

Off-Road Vehicle (ORV). A vehicle (including four wheel drive, trail bikes, hovercraft, snowmobiles, etc., but excluding helicopters, fixed wing aircraft and boats) capable of travelling off roads over land, water, ice, snow, sand, marshes, etc.

Opacity. The degree to which emissions reduce the transmission of light and obscure the view of an object in the background. A state which renders material partially or wholly impervious to rays of light and causes obstruction of an observer's view.

Overburden. The earth, rock, and other materials that lie above a mineral deposit.

Paleontology. A science that deals with the life of past geological periods and is based on the study of fossil remains of plants and animals.

Particulate Matter. Any material, except water in a chemically uncombined form, that is or has been airborne and exists as a liquid or a solid at standard temperature and pressure conditions. Minute particles of coal dust, fly ash, and oxides temporarily suspended in the atmosphere.

Passive Solar Cooling or Heating System. A solar heating system that uses windows on the south side of a building, permitting the sun's rays to warm the enclosure. Generally the building structure itself forms the heat distribution system. A solar cooling system utilizes blinds or shutters to deflect the heat of the sun in the summer.

Peaking Capacity. Generating equipment normally operated only during the hours of highest daily, weekly, or seasonal loads. Some generating equipment may be operated at certain times as peaking capacity and at other times to serve loads on a round-the-clock basis.

Peak Demand. The maximum electrical load needed in a stated period of time. It may be the maximum instantaneous load (or the maximum average load) within a designated interval of the stated period of time.

Peak Load. Maximum power load (megawatts) for a given period.

Perennial Stream. A stream or reach of a stream that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the region adjoining the stream.

Permeability. The property or capacity of a porous rock, sediment, or soil for transmitting a fluid without impairment of the structure of the medium; it is a measure of the relative ease of fluid flow under unequal pressure. The customary unit of measurement is the millidarcy.

Petroglyph. Figures, symbols, or scenes pecked or etched in rock.

pH. A number that represents the negative logarithm, base 10, of the hydrogen-ion activity of a solution. A pH less than 7 indicates an acid solution; a pH greater than 7 indicates an alkaline solution.

Photometer. An instrument for measuring luminous intensity.

Photochemical Oxidants. Chemicals which result from oxidation caused by exposure to sunlight.

Pipe Insulation. A material primarily designed to resist heat flow installed on a heating or cooling pipe in an unconditioned area of a building.

Plume. The volume of air space containing any of the substance emitted from a point source. For practical purposes, the limits of a plume have to be arbitrarily defined according to some minimum concentrations of the substance.

Point Source. An emitter of substances into the environment from a localized source.

Pooling (Power). Operation of two or more inter-connected electric systems to supply power in the most reliable and economical manner for their combined load requirements and maintenance program.

Potentiometric Surface. The potential level within or above an aquifer that water would rise to as a result of the hydraulic head within the formation.

Power. In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted, usually measured in watts.

Prevention of Significant Deterioration (PSD) Regulations. Regulations intended to protect uniquely clean air quality by not allowing further significant degradation. Areas may be designated Class I, II, or III. Industries or powerplants must apply for a Prevention of Significant Deterioration (PSD) permit from the Environmental Protection Agency.

Quaternary Alluvium. Water deposited sediments characterized by particle size sorting, rounded grains, and recent depositional origin (less than 3 million years).

Radioactive Nuclides. Radioactive particles which are emitted from power-plant stacks when coal is burned (all coal contains radioactive material).

Raptors. A group of carnivorous birds consisting of hawks, eagles, falcons, vultures, and owls.

Rate Structure Adjustments. Offering daily off-peak rates to each customer who is willing to pay metering costs.

Recharge Area. An area in which water is absorbed and eventually reaches the zone of saturation in one or more aquifers.

Reserve Capacity. Extra generating capacity available to meet unanticipated demands for power or to generate power in the event of loss of generation resulting from scheduled or unscheduled outages of regularly used generating capacity. Reserve capacity provided to meet the latter is also known as forced outage reserve.

"R-Value" Insulation. The heat resistant quality of an insulator as expressed by the R-value (the ability of a material to resist heat flow).

Scour Line. The level to which a stream may erode its own channel or floodplain.

Secondary Pollutants. New pollutants formed during the transport of emissions from a source.

Seismic Risk. Risk due to earthquakes or earth vibration, often measured logarithmically (Richter scale).

Slurry Pipeline. A pipeline usually constructed underground to transport coal in slurry form from the coal mine to the point of consumption (e.g., a powerplant).

Solar Domestic Hot Water Systems. Equipment designed to absorb the sun's energy and to use this energy to heat water for use in a building other than for space heating.

Solid Waste/Resource Recovery Systems. Systems which completely or partially combust municipal solid waste for the purpose of generating electrical power and/or steam (a biomass technology).

Specific Yield. The ratio of the volume of water a saturated specimen of rock will yield to its own total volume.

Spoil Pile. A pile or accumulation of dirt or rock which has been removed from its original location by mining operations.

Standard Industrial Classification (SIC). A system established by the Federal government to classify industrial, commercial, and agricultural enterprises by the products or services they provide.

Storage Coefficient. The volume of water an aquifer releases or takes into storage per unit surface area of the aquifer per unit changes in head.

Strip Mining. Any operation in connection with prospecting for, excavating, or mining minerals which results in a large-scale surface or stream bottom disturbance from stripping, trenching, dredging, rim cutting, or open-pit digging.

Subsidence. Movement in which surface material is displaced vertically downward.

Sulfur Oxides (SO_x). Compounds of sulfur combined with oxygen that have a significant influence on air pollution.

Sun Space Systems. A passive solar heating system whereby the solar collection and storage are thermally isolated from the living spaces of the building. The collector and storage function somewhat independently of the building, while the building can draw from the sunspace as its thermal requirements dictate. An atrium, a sunporch, a greenhouse, and a sunroom all represent potential examples of a sunspace.

Surface Mining. Mining method whereby the overlying materials are removed to expose the mineral for extraction.

Surface Mining Control and Reclamation Act of 1977 (PL 95-87 August 3, 1979). An act to establish the Office of Surface Mining Reclamation and Enforcement (OSM). The goals of the Act and OSM are to insure that coal is mined in an environmentally sound fashion and that previously mined-out areas are reclaimed and restored.

Suspended Sediment. Sediment which remains suspended in a water current.

Synfuels. Combustible fuels which must be processed, distilled, or refined from their naturally occurring state before they can be readily used. These include oil from oil shale and tar sands, and gas from coal.

Tailings Pond. A reservoir used as a depository for slurried wastes.

Tertiary. The first period of the Cenozoic era, thought to have included the span of time from 65 million years ago to about 2 to 1 million years ago.

Thermal Window. A window unit with improved thermal performance through the use of two or more sheets of glazing material affixed to a window frame to create one or more insulated air spaces. It may also have an insulating frame and sash.

Thermostat. An instrument which measures changes in temperature and controls devices for maintaining a desired temperature.

Threatened Species. Any animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Total Dissolved Solids (TDS). An aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts and are dissolved in water. High TDS values can adversely affect humans, animals, and plants. TDS is often used as a measure of salinity.

Trace Element. A chemical element found in small quantities (less than 1 percent) in a mineral or compound.

Transmissivity. The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient. The usual units in the United States are cubic feet per day per foot width of aquifer, usually expressed as square feet per day. Also known as transmissibility.

Turbidity. The quality of opaqueness due to the presence of suspended material. It is commonly expressed in Jacson Trubidity Units (JTU). These units are roughly proportional to milligrams per litre of suspended sediment: a range in JTU of 3 to 440 corresponds to a range in concentration of suspended sediment of about 5 to 1,000.

Valve Station: A station with shutoff capability strategically placed at a point along a coal slurry pipeline. Such stations are included in pipeline designs for safety and maintenance reasons.

Ventilation. That portion of supply air which comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

Visibility. How far a given object can be seen by the human eye. The greatest distance in a given direction at which it is just possible to see and identify, with the unaided eye in the daytime, a prominent dark object and, at nighttime, a known preferably unfocused, moderately intense light source. (Dictionary of Scientific Technical Terms, McGraw-Hill, New York, 1974.

Visibility Impairment. Reduction in visual range or atmospheric discoloration (Section 169A(g)6 of the Clean Air Act).

Visual Range. How far any object can be seen by the human eye. The distance under daylight conditions at which the contrast between a specified type of target and its background becomes just equal to the threshold contrasts of an observer. (Glossary of Meteorology. 1959. R.E. Huschke, Editor. American Meteorological Society, Boston, Massachusetts). Also defined as the farthest distance at which one can distinguish a black object against the sky with the naked eye. (Middleton, W.E.K. 1963. Vision Through the Atmosphere. Toronto Press, Toronto, Ontario). A first order approximation of daytime visual range is meteorological

range, which is the distance at which the human eye, with a threshold brightness contrast of 0.02 at a wavelength of 5,000 angstroms, can detect an ideal black object against the horizon sky in daytime.

Visual Resource Management System (VRM). Classification containing specific objectives for maintaining or enhancing visual resources, including the kinds of structures and modifications acceptable to meet established visual goals.

Visual Sensitivity. As applied to visual resource management, that degree of concern expressed by the user toward scenic quality and existing or proposed visual change in a particular characteristic landscape.

Volt. The unit of electrical potential (electromotive force) equal to the difference of potential between two points in a conducting wire, carrying a constant current of one ampere when the power dissipated between these two points is equal to one watt and equivalent to the potential difference across a resistance of one ohm when one ampere is flowing through it.

Vortex Sediment Ejection System. A sediment removal system using a vortex flow settling technique to remove heavier particles.

Waste Heat Recovery Systems. Equipment that uses waste heat as a substitute for a portion of the heat energy that would normally be required for heating/ cooling or domestic hot water systems.

Water Heater and Storage Tank Insulation. A material primarily designed to resist heat flow which is suitable for wrapping around the exterior surface of the storage tank or water heater casing.

Water Table. The surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Watt. The absolute unit of power equal to the rate of work represented by a current of one ampere under a pressure of one volt.

Wetlands. Lands containing significant amounts of soil moisture.

Wet-Lime Scrubber. A technology of removing air pollutants from powerplant emissions before their transmission into the atmosphere.

Wilderness Study Areas (WSAs). Areas determined through BLM's wilderness inventory to meet the definition of wilderness established by Congress.

Wind Energy Systems. Equipment that uses wind energy to produce energy in any form for personal purpose, agriculture, or other uses.

LIST OF ABBREVIATIONS

AC	alternating current
AO	Authorized Officer
AQMA	Air Quality Maintenance Area
AWT	Advanced Wastewater Treatment
AWV	Allen-Warner Valley
BACT	Best Available Control Technology
BAQ	Bureau of Air Quality
BLM	Bureau of Land Management
Btu	British thermal unit
Btu/lb	British thermal units per pound
CAAQS	California Ambient Air Quality Standards
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO ₂	carbon dioxide
CO	carbon monoxide
CPUC	California Public Utilities Commission
CTGM	Complex Terrain Grid Model
CU	<u>Development of Coal Resources in Central Utah Environmental State-</u> <u>ment</u> , U.S. Department of the Interior, 1979
DC	Direct current
DEP	Department of Environmental Protection
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMRIA	Energy Mineral Rehabilitation Inventory and Analysis
EMSL	Environmental Monitoring and Support Laboratory
EPA	Environmental Protection Agency
ERT	Energy Research and Technology
ES	Environmental Statement
FIRE	finance, insurance, and real estate
FLPMA	Federal Land Policy Management Act

ft ³ /s	cubic feet per second
gmp	gallons per minute pumped
gpd	gallons per day
gpm	gallons per minute
H ₂ S	hydrogen sulfide
ICPA	Intermountain Consumer Power Association
IPA	Intermountain Power Association
IPP	Intermountain Power Project
ISC	Industrial Source Complex Model
JTU	Jacson Turbidity Units
km	kilometer
kV	kilovolt
kW	kilowatt
kWh	kilowatt hours
LASL	Los Alamos Scientific Laboratory
m	meter
m/s	meters per second
M&I	municipal and industrial
mg/l	milligrams per liter
mgd	million gallons per day
mt/y	million tons per year
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMHC	non-methane hydrocarbon
NO _x	nitrogen oxides
NO ₂	nitrogen dioxide
NPC	Nevada Power Company
NPS	National Park Service
NSPS	New Source Performance Standards
ORV	off-road vehicle
OSM	Office of Surface Mining Reclamation and Enforcement
O ₃	ozone
Pb	lead
PG&E	Pacific Gas and Electric

PL	Public Law
PSD	Prevention of Significant Deterioration
SAI	Systems Applications Inc.
SCE	Southern California Edison
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
SMUD	Sacramento Municipal Utility District
SO ₂	sulfur dioxide
SU	<u>Development of Coal Resources in Southern Utah Environmental State-</u> <u>ment</u> , U.S. Department of the Interior, 1979
SUPED	<u>Southern Utah Petition Evaluation Document</u> , U.S. Department of the Interior, 1980
SW	<u>Development of Coal Resources in Southwestern Wyoming Environmental</u> <u>Statement</u> , U.S. Department of the Interior, 1978
TCU	transportation, communications, and utilities
TDS	total dissolved solids
TSP	total suspended particulates
UDWR	Utah Division of Wildlife Resources
UII	Utah International Incorporated
UP	Union Pacific
UP&L	Utah Power and Light
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	visual resource management
WSA	Wilderness Study Area
µg/m ³	micrograms per cubic meter

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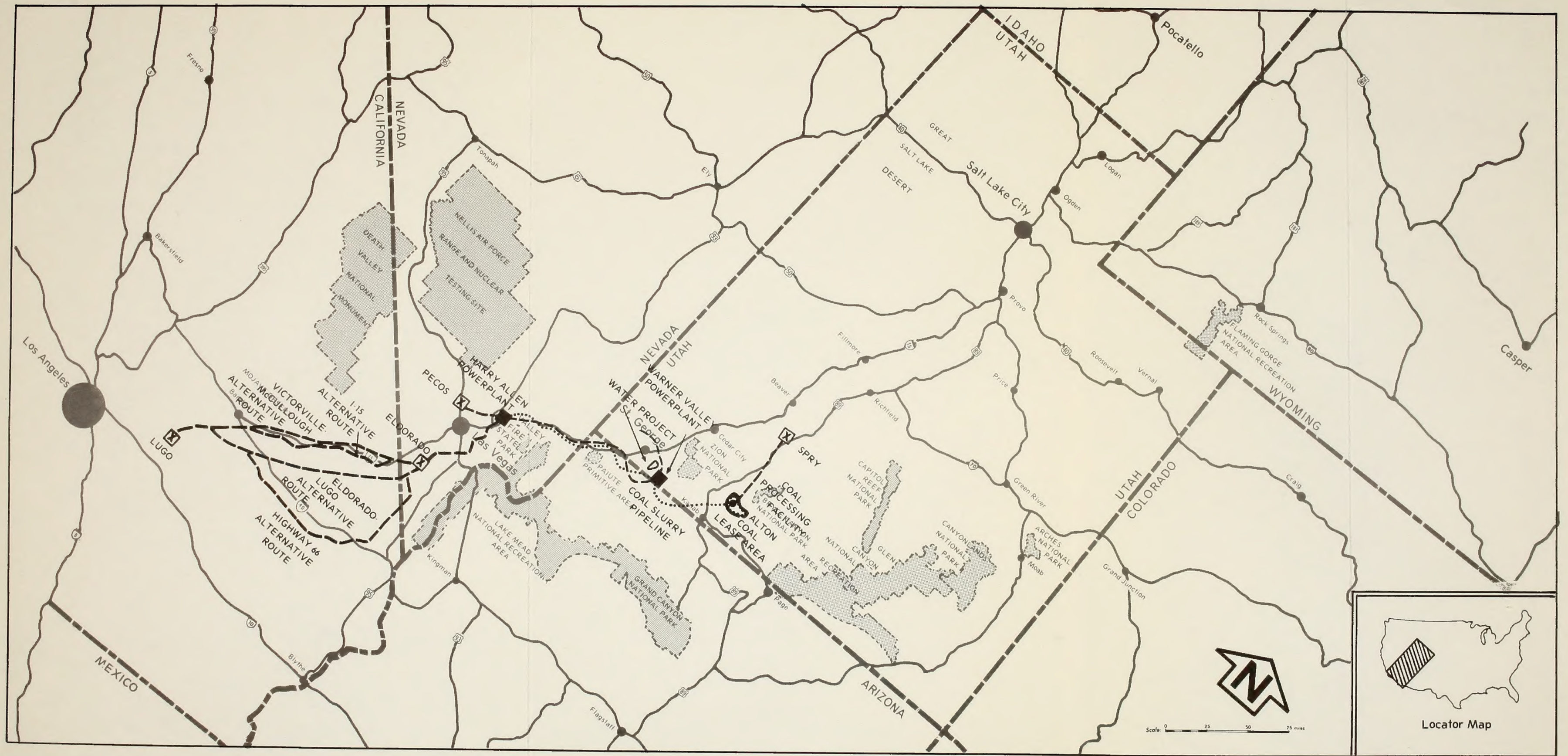
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Woundfin Minnow: See Wildlife

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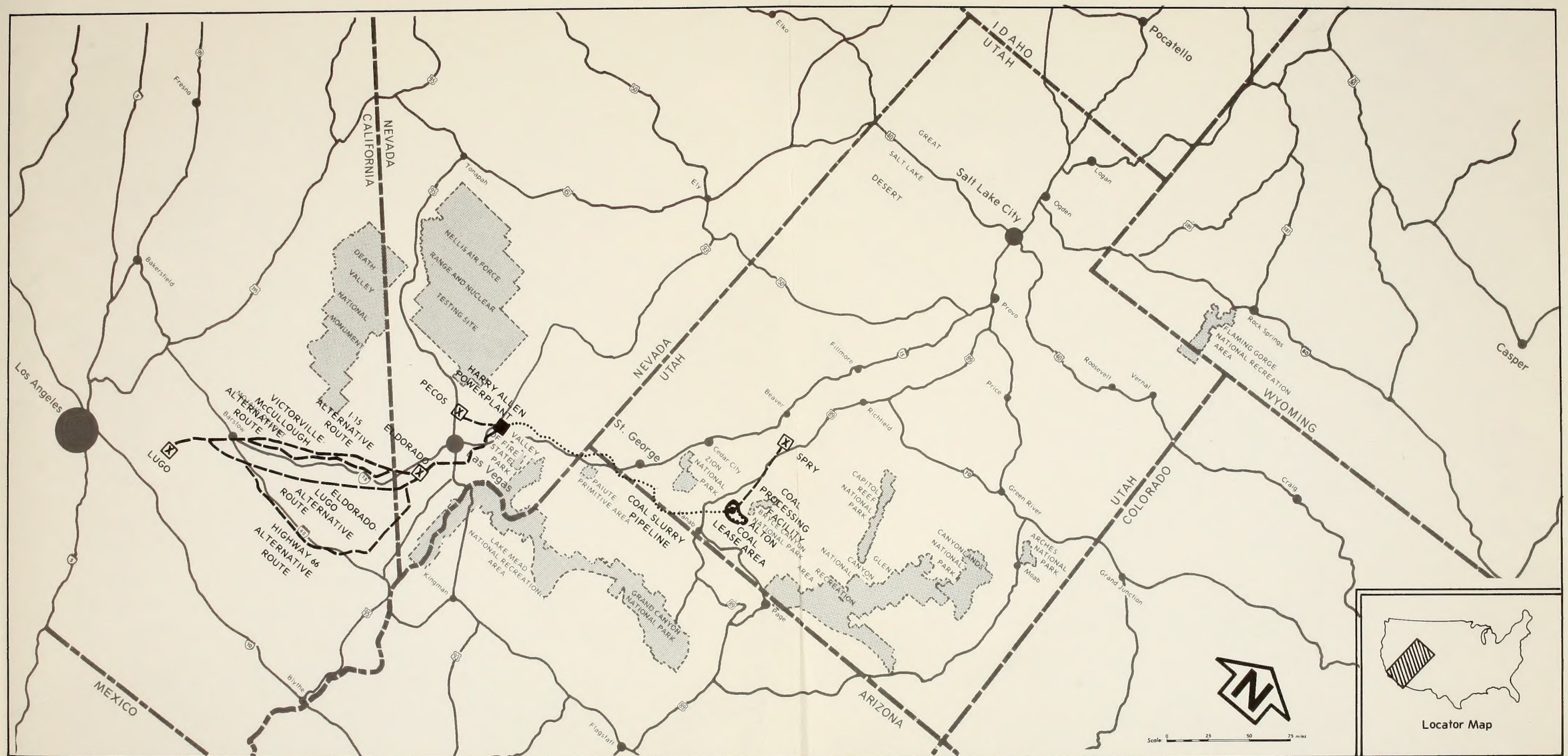


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Bureau of Land Management

ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

- LEGEND**
- Transmission Route
 - ☒ Coal Source
 - Substation
 - Powerplant
 - Coal Slurry Pipeline

FIGURE 2-1
ALTERNATIVE 1
SYSTEM COMPONENTS

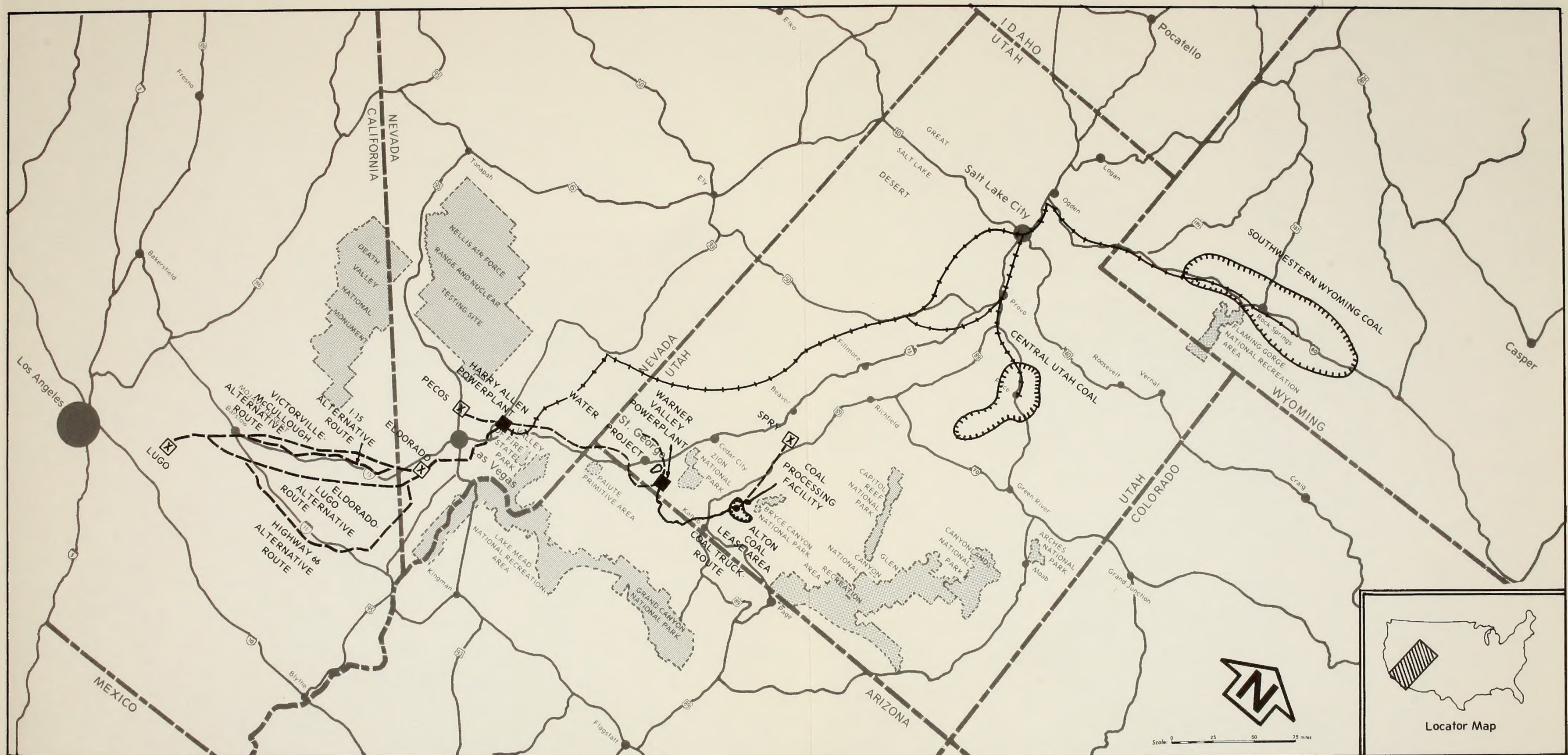


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Bureau of Land Management

ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

- LEGEND**
- Transmission Route
 - Coal Source
 - ⊗ Substation
 - Powerplant
 - Coal Slurry Pipeline

FIGURE 2-10
ALTERNATIVE 2
SYSTEM COMPONENTS

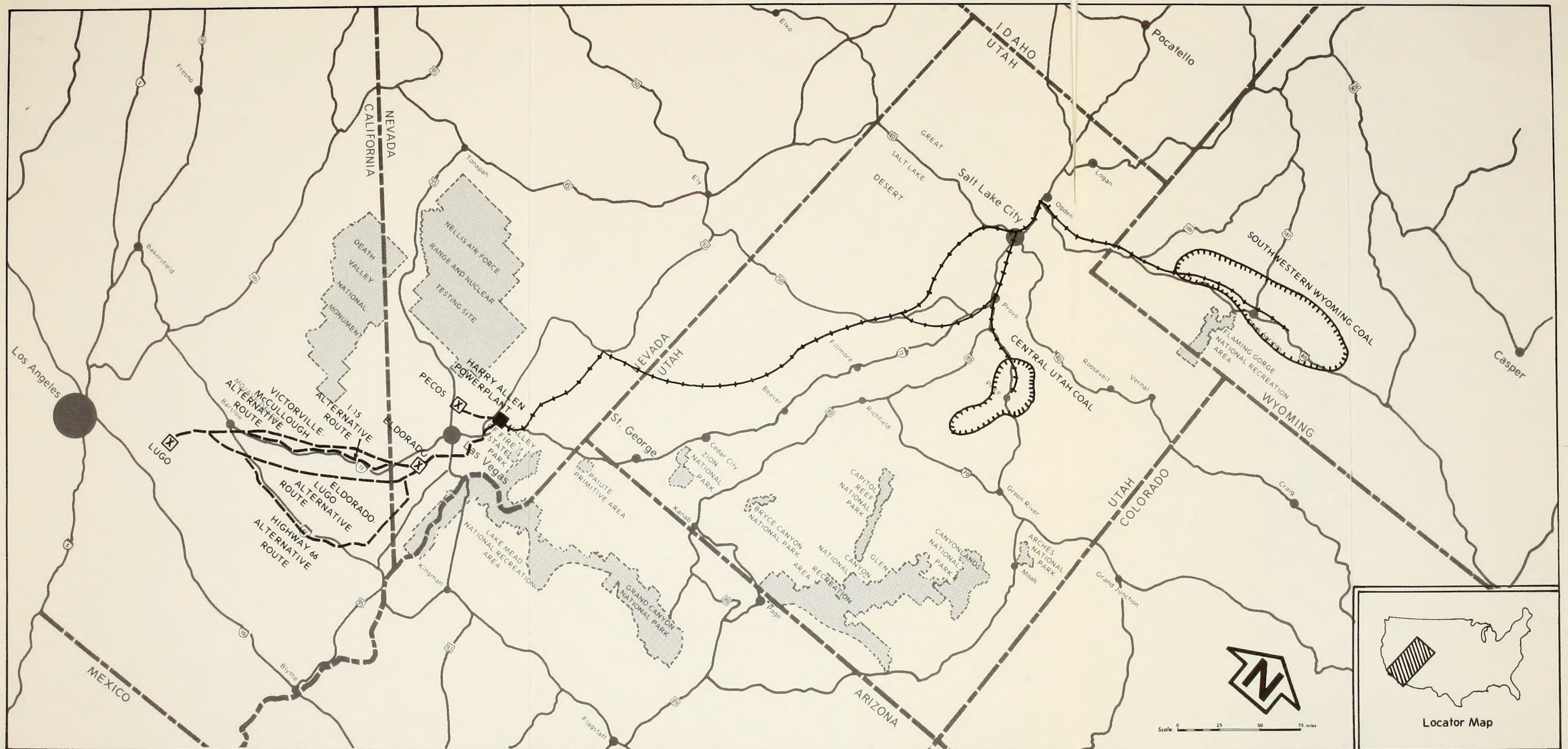


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Bureau of Land Management

ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

- LEGEND**
- +—+— Railroad Lines
 - - - - - Transmission Route
 - - - - - Coal Source
 - ⊠ Substation
 - Powerplant
 - Coal Truck Route

FIGURE 2-11
ALTERNATIVE 3
SYSTEM COMPONENTS



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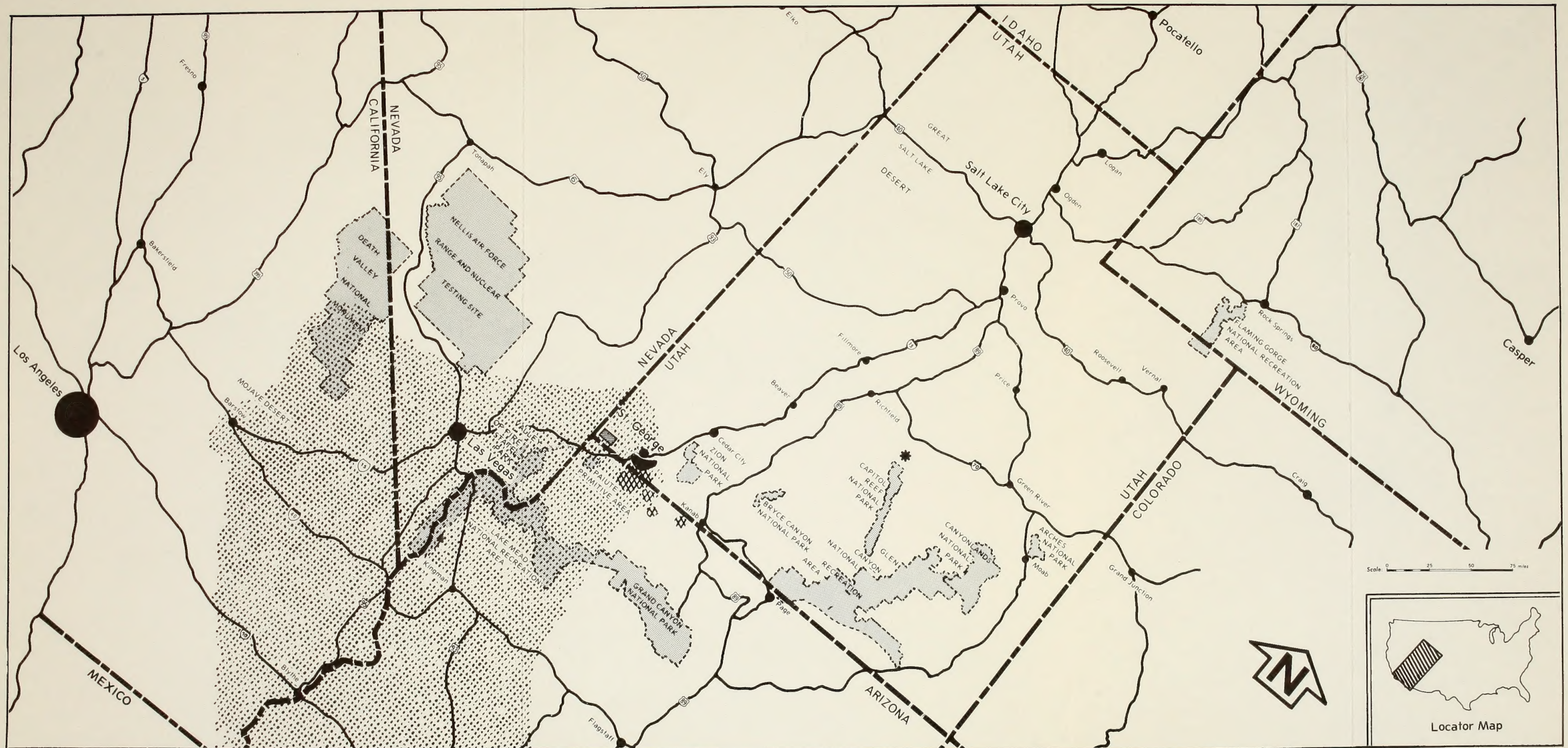
ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

- Railroad Lines
- Transmission Route
- Coal Source
- Substation
- Powerplant

FIGURE 2-14

ALTERNATIVE 4
SYSTEM COMPONENTS



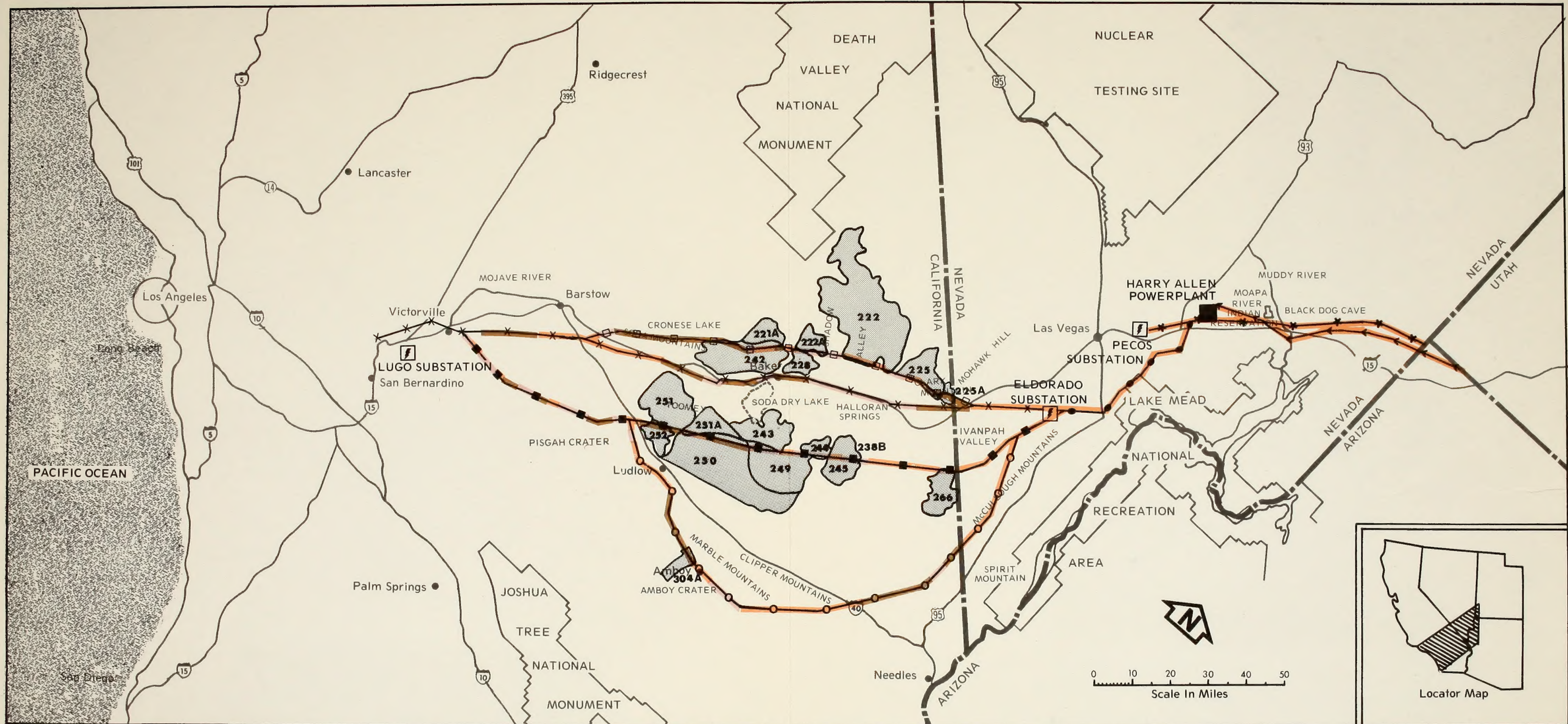
United States Department of the Interior
Bureau of Land Management

ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

-  Desert Tortoise Habitat
-  Critical Desert Tortoise Habitat
-  Dwarf Bearclaw Poppy (*Arctomecon humilus*)
-  Silver Cholla Cactus (*Pediocactus sileri*)
-  *Townsendia aprica*

FIGURE 3-6
VEGETATION AND WILDLIFE
SPECIES OF CONCERN



United States Department of The Interior
Bureau of Land Management

ALLEN - WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

- PROPOSED ELECTRICAL TRANSMISSION ROUTES**
- Highway 66 Route
 - X—X I-15 Route
 - Eldorado-Lugo
 - Victorville-McCullough
 - Allen-Eldorado
 - *—* Warner-Pecos

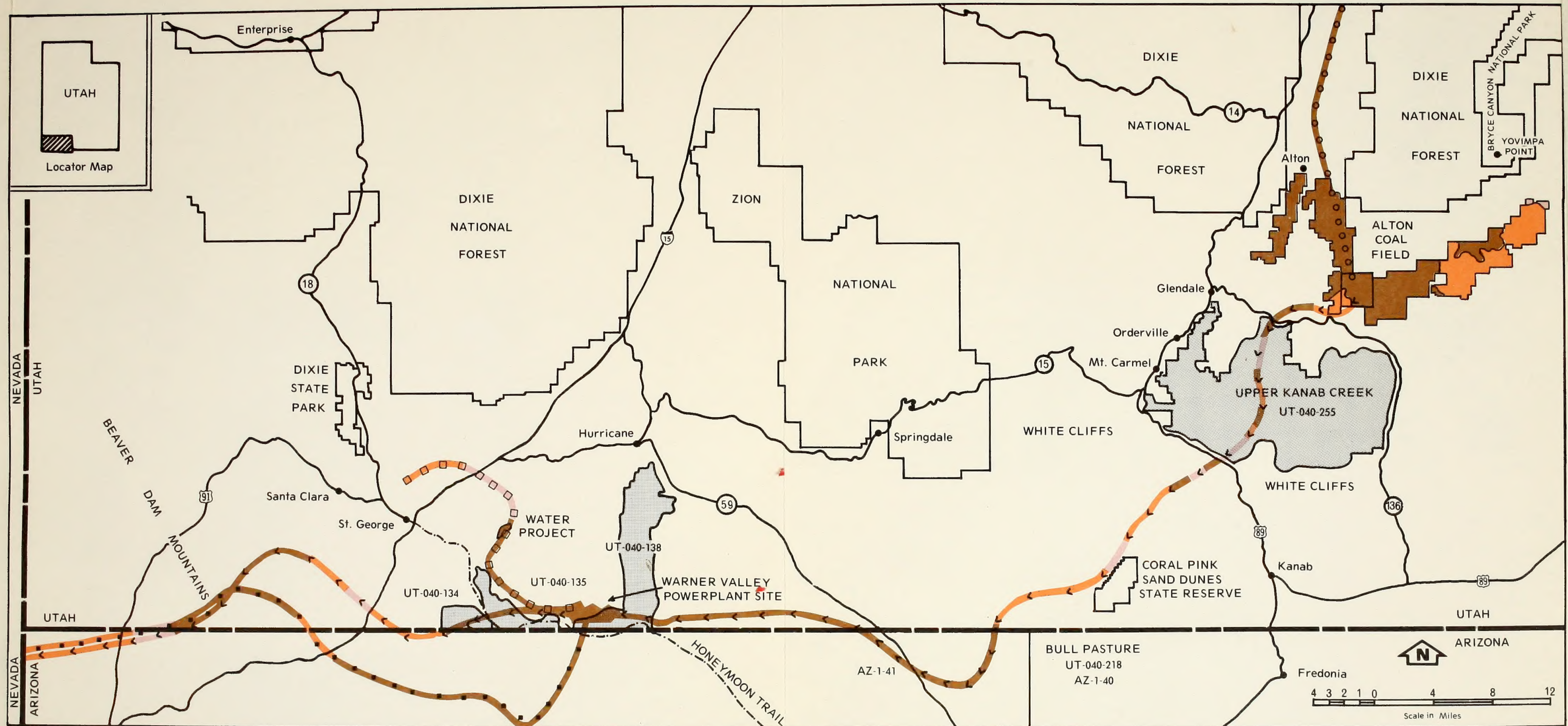
PROPOSED COAL TRANSPORTATION SYSTEM

- ←←← Coal Slurry Pipeline
- WILDERNESS**
- Wilderness Study Area

VISUAL RESOURCE MANAGEMENT CLASSES

- CLASS II—Changes in any of the basic elements caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention.
- CLASS III—Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing landscape.
- CLASS IV—Contrasts may attract attention and be a dominant feature of the landscape in terms of scale. However, the change should repeat the basic elements inherent in the landscape.

FIGURE 3-8
PROPOSED ELECTRICAL
TRANSMISSION ROUTES AND
PROPOSED COAL SLURRY PIPELINE
IN CALIFORNIA AND NEVADA



United States Department of the Interior
Bureau of Land Management

ALLEN-WARNER VALLEY ENERGY SYSTEM ENVIRONMENTAL IMPACT STATEMENT

LEGEND

PROPOSED ELECTRICAL TRANSMISSION ROUTES

- ○ Spry To Alton
- □ Warner To St. George
- ■ Warner To Pecos

PROPOSED COAL TRANSPORTATION SYSTEM

- < < Coal Slurry Pipeline

WILDERNESS

- Intensive Wilderness Inventory Units

Visual Resource Management Classes

- CLASS II-Changes in any of the basic elements caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention.
- CLASS III-Contrasts to the basic elements caused by a management activity may be evident and begin to attract attention in the characteristic landscape. However, the changes should remain subordinate to the existing landscape.
- CLASS IV-Contrasts may attract attention and be a dominant feature of the landscape in terms of scale. However, the change should repeat the basic elements inherent in the landscape.

FIGURE 3-9

PROPOSED ELECTRICAL
TRANSMISSION ROUTES AND
PROPOSED COAL SLURRY PIPELINE
IN UTAH AND ARIZONA

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WER	OFFICE	DATE RETURNED
4071 due ~~10/15/87~~	~~10/15/87~~	REC 14 '87
ELK020 NV-015		

(Continued on reverse)

